Fisher® FIELDVUE™ DLC3020f Digital Level Controller for FOUNDATION™ fieldbus

This manual applies to:

Device Type	3020
Device Revision	1
Hardware Revision	1.0
Firmware Revision	1.0
DD Revision	0x03

Contents

Section 1 Introduction and Specifications

Scope of Manual

This instruction manual includes specifications, installation, operating, and maintenance information for the FIELDVUE DLC3020f digital level controller.

This manual describes device setup using AMS Suite: Intelligent Device Manager version 10.5 and later. You can also use the 475 or the 375 Field Communicator to setup the DLC3020f.

Note

This manual documents procedures in AMS Device Manager 10.5 and later. Earlier versions of AMS Device Manager contain the same procedures and methods, but access is through the block in which they reside.

Do not install, operate, or maintain a DLC3020f digital level controller without being fully trained and qualified in field instrument and accessory installation, operation, and maintenance. **To avoid personal injury or property damage, it is important to carefully read, understand, and follow all of the contents of this manual, including all safety cautions and warnings.** If you have any questions regarding these instructions contact your Emerson Process Management sales office before proceeding.

Instrument Description

The FIELDVUE DLC3020f digital level controller is a fieldbus communicating instrument used to measure liquid level or the level of interface between two liquids using displacement sensor technology.

In addition to the normal function of reporting process level PV, the DLC3020f, using FOUNDATION fieldbus protocol, gives easy access to information critical to process operation and will readily integrate into a new or existing control system. AMS Suite: Intelligent Device Manager or the 475 Field Communicator can be used to configure, calibrate, or test the digital level controller.

The DLC3020f is also designed to directly replace pneumatic, analog, or HART® transmitters/ controllers. It can be mounted on a wide variety of 249 cageless and caged level sensors as well as on other displacer type level sensors through the use of mounting adaptors.

249 Caged Sensors (see table 1-7)

- 249, 249B, 249BF, 249C, 249K, and 249L sensors side-mount on the vessel with the displacer mounted inside a cage outside the vessel. (The 249BF caged sensor is available only in Europe, Middle East, and Africa.)

249 Cageless Sensors (see table 1-8)

- 249BP, 249CP, and 249P sensors top-mount on the vessel with the displacer hanging down into the vessel.
- 249VS sensor side-mounts on the vessel with the displacer hanging out into the vessel.
- 249W wafer-style sensor mounts on top of a vessel or on a customer-supplied cage.

Foundation Fieldbus Blocks

Instrument Blocks

The digital level controller is a block-based device. For detailed information on the blocks within the digital level controller, see the Parameter section.

- Resource Block—The resource block contains the hardware specific characteristics associated with a device; it has no input or output parameters. The resource block monitors and controls the general operation of other blocks within the device. For example, when the mode of the resource block is Out of Service, it impacts all function blocks.
- Transducer Blocks—The transducer block takes an analog signal and converts it to a level or interface reading. The DLC3020f has two transducer blocks, one for the device, and one for the display.

Function Blocks

In addition to the resource and transducer block, the digital level controller contains the following function blocks. For additional information on function blocks, refer to the Parameter section.

- Analog Input (AI) Function Block—The analog input function block monitors the signal from a DLC3020f sensor and makes the level or interface available to another block.
- Proportional-Integral-Derivative (PID) Function Block—The PID function block performs proportional-plus-integral-plus-derivative control.
- Discrete Input (DI) Function Block (2) —The discrete input function block processes a single discrete input from a DLC3020f and makes it available to other function blocks. In the digital level controller, the DI function block can provide a user defined on/off switch indication.
- Analog Output (AO) Function Block (3) —The analog output function block accepts the output from another function block and transfers it to the transducer block to use, for example, for process temperature compensation or direct density readings.
- Input Selector (ISEL) Function block—The input selector function block selects from up to four inputs and may provide the selected signal as input to the PID block. The input selection can be configured to select the first good input signal; a maximum, minimum or average value; or a hot spare.
- Arithmetic (ARTH) Function Block—The arithmetic function block is used to calculate an output value that is based on the value of IN and the auxiliary inputs, if used. IN_LO is used if an extended range flow measurement is required from a differential pressure flow meter, like an orifice plate or venturi. Each of IN_1, IN_2 and IN_3 may be adjusted by a bias and a gain, and then used as terms in an equation selected by the parameter ARITH_TYPE.

Using This Manual

This manual describes using AMS Device Manager to calibrate and configure the DLC3020f as well as information on using the Field Communicator.

Navigation paths for Configuration and Calibration procedures are included for both AMS Device Manager and the Field Communicator.

For example, to access *Guided Calibrations*:

AMS Device Manager	Configure > Calibrate > Guided Calibrations
Field Communicator	Configure > Calibrate > Full Calibration (Bench) or Full Calibration (Field)

Field Communicator menu structures for the function blocks and the resource and transducer blocks are included in the Blocks section.

Throughout this document, parameters are typically referred to by their common name or label, followed by the parameter name and index number; for example, Write Priority (WRITE_PRI [39]). However, not all interface systems support the use of the parameter label and instead use only the Parameter Name, followed by the index number, when referring to the block parameters.

Specifications

Specifications for DLC3020f are shown in table 1-2. Specifications for 249 sensors are shown in table 1-5.

Related Information

Fieldbus Installation and Wiring Guidelines

This manual describes how to connect the fieldbus to the digital level controller. For a technical description, planning, and installation information for a FOUNDATION fieldbus, refer to the FOUNDATION fieldbus Technical Overview available from the Fieldbus Foundation.

Related Documents

Other documents containing information related to the DLC3020f digital level controllers and 249 sensors include:

- Bulletin 11.2:DLC3020f - FIELDVUE DLC3020f Digital Level Controllers (D103433X012)
- FIELDVUE DLC3020f Quick Start Guide (D103470X012)
- Bulletin 34.2:249 - Fisher 249 Sensor, Level Controller, and Transmitter Dimensions (D200039X012)
- Fisher 249 Caged Displacer Sensors Instruction Manual (D200099X012)
- Fisher 249 Cageless Displacer Sensors Instruction Manual (D200100X012)
- Fisher 249VS Cageless Displacer Sensor Instruction Manual (D103288X012)
- Fisher 249W Cageless Wafer Style Level Sensor Instruction Manual (D102803X012)
- Simulation of Process Conditions for Calibration of Fisher Level Controllers and Transmitters (D103066X012)
- Bolt Torque Information (D103220X012)
- Technical Monograph 7: The Dynamics of Level and Pressure Control
- Technical Monograph 26: Guidelines for Selection of Liquid Level Control Equipment

These documents are available from your Emerson Process Management sales office. Also visit our website at www.Fisher.com.

Educational Services

For information on available courses for the DLC3020f digital level controller, as well as a variety of other products, contact:

Emerson Process Management
Educational Services, Registration
Phone: +1-641-754-3771 or +1-800-338-8158
e-mail: education@emerson.com
http://www.emersonprocess.com/education

Table 1-2. Specifications

Available Configurations

Mounts on 249 caged and cageless sensors.

Function: Transmitter, Controller, Switch

Communications Protocol: FOUNDATION fieldbus

Digital Communication Protocol

FOUNDATION fieldbus registered device (ITK 5)

Supply Requirements

9 to 32 volts DC, 17.7 mA DC;
instrument is not polarity sensitive

Device Inputs

Level Sensor Input (required)
Rotary motion of torque tube shaft is proportional to buoyant force of the displacer caused by changes in liquid level or interface level

Process Temperature Compensation Input (optional)
RTD—interface for 2- or 3-wire 100 ohm platinum RTD
AO Block—FOUNDATION fieldbus temperature transmitter
Manual—compensation values manually entered in the device

LCD Meter Indications

Process Variable in engineering units
Process Variable in percent (%) only
Alternating Process Variable in engineering units and percent (%)
Optional: Alerts as configured

Function Block Suite

AI, PID, DI (two), AO (three), ISEL, and an ARTH function block

Block Execution Times

AI, PID, DI, AO, ISEL: 15 ms
ARTH: 25 ms

Fieldbus Device Capabilities

Backup Link Active Scheduler (BLAS)

Performance

Criteria	DLC3020f(1)
Independent Linearity	±0.1% of output span
Accuracy	±0.15%
Repeatability	<0.1% of full scale output
Hysteresis	<0.10% of output span
Deadband	<0.05% of input span
Humidity	±0.10% (RH9.2% to 90%)

Note: At full design span, reference conditions.
1. To lever assembly rotation inputs.

Minimum Differential Specific Gravity

0.1 SGU with standard volume displacers

Ambient Temperature Effect

The combined temperature effect on zero and span is less than 0.01% of full scale per degree Celsius over the operating range -40 to 80°C (-40 to 176°F)

Process Temperature Effect

Temperature compensation can be implemented to correct for fluid density changes due to process temperature variations. See page 31 for information on how to correct with temperature compensation.

Electromagnetic Compatibility

Meets EN 61326-1 (First Edition)
Immunity—Industrial locations per Table 2 of the EN 61326-1 standard. Performance is shown in table 1-3 below.
Emissions—Class A
ISM equipment rating: Group 1, Class A

Lightning and Surge Protection—The degree of immunity to lightning is specified as Surge immunity in table 1-3. For additional surge protection commercially available transient protection can be used.

-continued-

Table 1-2. Specifications (continued)

Alerts and Diagnostics

Electronic Alerts advise when there is an electronic error in memory

Operational Range Alerts notify when PV range and sensor range changes might affect calibration

Rate Limit Alerts indicate rapid rise or fall in displacer, which can signify abnormal operating conditions

RTD Alerts show health and condition of connected RTD

Sensor Board Alerts indicate if the device is operating above or below maximum recommended limits; advises if the electronic sensor electronics cannot communicate properly

Input Compensation Error Alerts advise of "Bad" or "Uncertain" status of AO connection or setup.

Simulate Function

Simulate Active, when enabled, simulates an active alert without making it visible.

Operating Limits

Process Temperature: See table 1-4 and figure 2-8

Ambient Temperature[1] and Humidity

Conditions	Normal Limits	Transport and Storage Limits	Nominal Reference
Ambient Temperature	-40 to 80°C (-40 to 176°F)	-40 to 85°C (-40 to 185°F)	25°C (77°F)
Ambient Relative Humidity	0 to 95% (non-condensing)		40%

Electrical Classification

Hazardous Area:

CSA— Intrinsically Safe, Explosion-proof, Division 2, Dust Ignition-proof

FM— Intrinsically Safe, Explosion-proof, Non-Incendive, Dust Ignition-proof

ATEX— Intrinsically Safe, Flameproof, Type n

IECEx— Intrinsically Safe, Flameproof, Type n

Electrical Housing:

CSA— Type 4X

FM— NEMA 4X, IP66

ATEX— IP66

IECEx— IP66

Mounting Positions

Digital level controllers can be mounted right- or left-of-displacer, as shown in figure 2-5

Construction Materials

Case and Cover: Low-copper aluminum alloy
Internal: Plated steel, aluminum, and stainless steel; encapsulated printed wiring boards; Neodymium Iron Boron Magnets

Electrical Connections

Two 1/2-14 NPT internal conduit connections; one on bottom and one on back of terminal box. M20 adapters available.

Weight

Less than 2.7 Kg (6 lbs)

Options

■ Heat insulator ■ Mountings for Masoneilan™, Yamatake, and Foxboro™-Eckhardt displacers available

Declaration of SEP

Fisher Controls International LLC declares this product to be in compliance with Article 3 paragraph 3 of the Pressure Equipment Directive (PED) 97 / 23 / EC. It was designed and manufactured in accordance with Sound Engineering Practice (SEP) and cannot bear the CE marking related to PED compliance.

However, the product *may* bear the CE marking to indicate compliance with *other* applicable European Community Directives.

1. The pressure/temperature limits in this manual and any applicable standard or code limitation for valve should not be exceeded.

Table 1-3. FIELDVUE DLC3020f EMC Summary Results—Immunity

Port	Phenomenon	Basic Standard	Test Level	Performance Criteria(1)
Enclosure	Electrostatic discharge (ESD)	IEC 61000-4-2	4 kV contact 8 kV air	A
	Radiated EM field	IEC 61000-4-3	80 to 1000 MHz @ 10V/m with 1 kHz AM at 80% 1400 to 2000 MHz @ 3V/m with 1 kHz AM at 80% 2000 to 2700 MHz @ 1V/m with 1 kHz AM at 80%	A
	Rated power frequency magnetic field	IEC 61000-4-8	30 A/m at 50/60 Hz	A
I/O signal/control	Burst	IEC 61000-4-4	1 kV	A
	Surge	IEC 61000-4-5	1 kV (line to ground only, each)	A
	Conducted RF	IEC 61000-4-6	150 kHz to 80 MHz at 3 Vrms	A

1. Performance criteria: +/- 1% effect. A = No degradation during testing. B = Temporary degradation during testing, but is self-recovering.

Table 1-4. Allowable Process Temperatures for Common Fisher 249 Sensor Pressure Boundary Materials

MATERIAL	PROCESS TEMPERATURE	
	Minimum	Maximum
Cast Iron	-29°C (-20°F)	232°C (450°F)
Steel	-29°C (-20°F)	427°C (800°F)
Stainless Steel	-198°C (-325°F)	427°C (800°F)
N04400	-198°C (-325°F)	427°C (800°F)
Graphite Laminate/SST Gaskets	-198°C (-325°F)	427°C (800°F)
N04400/PTFE Gaskets	-73°C (-100°F)	204°C (400°F)

Table 1-5. Fisher 249 Sensor Specifications

Input Signal

Liquid Level or Liquid-to-Liquid Interface Level: From 0 to 100 percent of displacer length
Liquid Density: From 0 to 100 percent of displacement force change obtained with given displacer volume—standard volumes are ■ 980 cm^3 (60 $inches^3$) for 249C and 249CP sensors or ■ 640 cm^3 (100 $inches^3$) for most other sensors; other volumes available depending upon sensor construction

Sensor Displacer Lengths

See tables 1-7 and 1-8 footnotes

Sensor Working Pressures

Consistent with applicable ANSI pressure/temperature ratings for the specific sensor constructions shown in tables 1-7 and 1-8

Caged Sensor Connection Styles

Cages can be furnished in a variety of end connection styles to facilitate mounting on vessels; the equalizing connection styles are numbered and are shown in figure 1-1.

Mounting Positions

Most level sensors with cage displacers have a rotatable head. The head may be rotated through 360 degrees to any of eight different positions, as shown in figure 2-5.

Construction Materials

See tables 1-6, 1-7, and 1-8

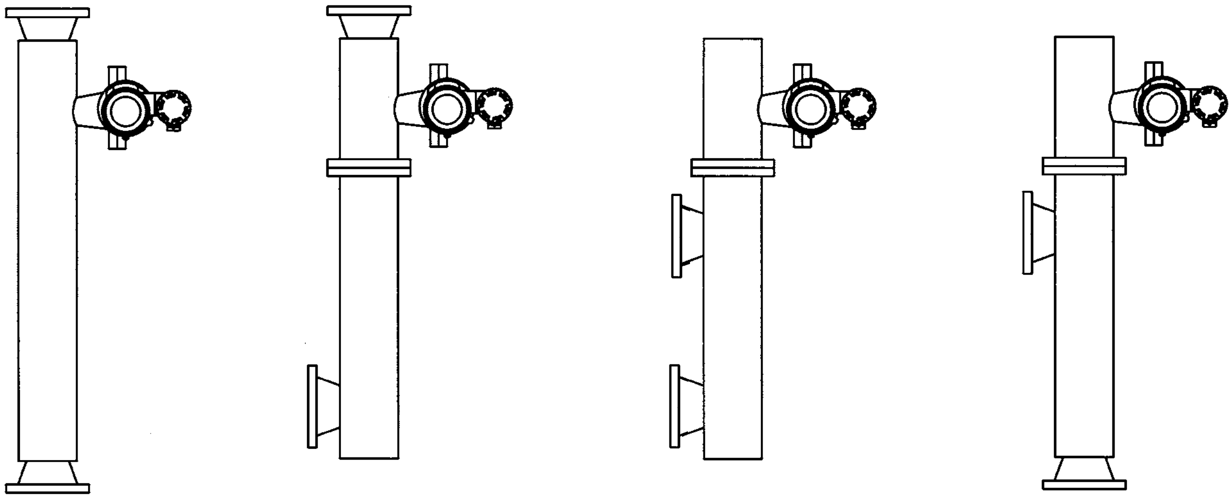
Operative Ambient Temperature

See table 1-4
For ambient temperature ranges, guidelines, and use of optional heat insulator, see figure 2-8.

Options

■ Heat insulator, see description under Ordering Information ■ Gauge glass for pressures to 29 bar at 232°C (420 psig at 450°F), and ■ Reflex gauges for high temperature and pressure applications

Figure 1-1. Style Number of Equalizing Connections



STYLE 1
TOP AND BOTTOM CONNECTIONS
SCREWED (S-1) OR FLANGED (F-1)

STYLE 2
TOP AND LOWER SIDE CONNECTIONS
SCREWED (S-2) OR FLANGED (F-2)

STYLE 3
UPPER AND LOWER SIDE CONNECTIONS
SCREWED (S-3) OR FLANGED (F-3)

STYLE 4
UPPER SIDE AND BOTTOM CONNECTIONS
SCREWED (S-4) OR FLANGED (F-4)

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Table 1-6. Displacer and Torque Tube Materials

Part	Standard Material	Other Materials
Displacer	304 Stainless Steel	316 Stainless Steel, N10276, N04400, Plastic, and Special Alloys
Displacer Stem, Driver Bearing, Displacer Rod and Driver	316 Stainless Steel	N10276, N04400, other Austenitic Stainless Steels, and Special Alloys
Torque Tube	N05500[1]	316 Stainless Steel, N06600, N10276
1. N05500 is not recommended for spring applications above 232°C (450°F). Contact your Emerson Process Management sales office or application engineer if temperatures exceeding this limit are required.		

Table 1-7. Caged Displacer Sensors(1)

TORQUE TUBE ORIENTATION	SENSOR	STANDARD CAGE, HEAD, AND TORQUE TUBE ARM MATERIAL	EQUALIZING CONNECTION		PRESSURE RATING(2)
			Style	Size (NPS)	
Torque tube arm rotatable with respect to equalizing connections	249(3)	Cast iron	Screwed	1-1/2 or 2	CL125 or CL250
			Flanged	2	
	249B, 249BF(4)	Steel	Screwed or optional socket weld	1-1/2 or 2	CL600
			Raised face or optional ring-type joint flanged	1-1/2	CL150, CL300, or CL600
				2	CL150, CL300, or CL600
	249C(3)	316 stainless steel	Screwed	1-1/2 or 2	CL600
			Raised face flanged	1-1/2	CL150, CL300, or CL600
				2	CL150, CL300, or CL600
	249K	Steel	Raised face or optional ring-type joint flanged	1-1/2 or 2	CL900 or CL1500
	249L	Steel	Ring-type joint flanged	2(5)	CL2500

1. Standard displacer lengths for all styles (except 249) are 14, 32, 48, 60, 72, 84, 96, 108 and 120 inches. The 249 uses a displacer with a length of either 14 or 32 inches.
2. EN flange connections available in EMA (Europe, Middle East and Africa).
3. Not available in EMA.
4. The 249BF available in EMA only. Also available in EN size DN 40 with PN 10 to PN 100 flanges and size DN 50 with PN 10 to PN 63 flanges.
5. Top connection is NPS 1 ring-type joint flanged for connection styles F1 and F2.

Table 1-8. Cageless Displacer Sensors(1)

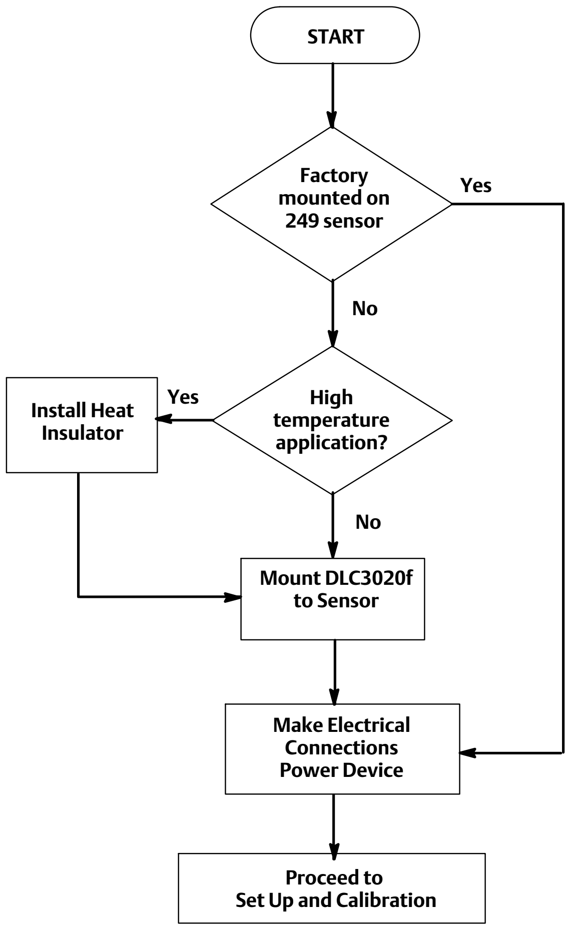
Mounting	Sensor	Standard Head(2), Wafer Body(6) and Torque Tube Arm Material	Flange Connection (Size)	Pressure Rating(3)
Mounts on top of vessel	249BP(4)	Steel	NPS 4 raised face or optional ring-type joint	CL150, CL300, or CL600
			NPS 6 or 8 raised face	CL150 or CL300
	249CP	316 Stainless Steel	NPS 3 raised face	CL150, CL300, or CL600
	249P(5)	Steel or stainless steel	NPS 4 raised face or optional ring-type joint	CL900 or 1CL500 (EN PN 10 to DIN PN 250)
			NPS 6 or 8 raised face	CL150, CL300, CL600, CL900, CL1500, or CL2500
Mounts on side of vessel	249VS	LCC, WCC (steel), CF8M	For NPS 4 raised face or flat face	CL125, 150, 250, 300, 600, 900, or 1500 (EN PN 10 to DIN PN 160)
			For NPS 4 butt weld end, XXS	CL2500
Mounts on top of vessel or on customer supplied cage	249W	WCC (steel) or CF8M	For NPS 3 raised face	CL150, CL300, or CL600
		LCC (steel) or CF8M	For NPS 4 raised face	CL150, CL300, or CL600

1. Standard displacer lengths are 14, 32, 48, 60, 72, 84, 96, 108, and 120 inches.
2. Not used with side-mounted sensors.
3. EN flange connections available in EMA (Europe, Middle East and Africa).
4. Not available in EMA.
5. 249P available in EMA only.
6. Wafer Body only applicable to the 249W.

Section 2 Installation

This section contains digital level controller installation information including an installation flowchart (figure 2-1), mounting and electrical installation information.

Figure 2-1. Installation Flowchart



Configuration: On the Bench or in the Field

Configure the digital level controller before or after installation in the field.

It may be useful to configure the instrument on the bench before installation to ensure proper operation, and to familiarize yourself with its functionality.

Protecting the Coupling and Flexures

CAUTION

Damage to flexures and other parts can cause measurement errors. Observe the following steps before moving the sensor and controller.

Lever Lock

The lever lock is built in to the coupling access handle. When the handle is open, it positions the lever in the neutral travel position for coupling. In some cases, this function is used to protect the lever assembly from violent motion during shipment.

A DLC3020f digital level controller will have one of the following mechanical configurations when received:

1. A fully assembled and coupled caged-displacer system shipped with the displacer or driver rod blocked within the operating range by mechanical means. In this case, the access handle (figure 2-2) will be in the unlocked position. Remove the displacer blocking hardware before calibration. (See the appropriate sensor instruction manual). The coupling should be intact.

CAUTION

When shipping an instrument mounted on a sensor, if the lever assembly is coupled to the linkage, and the linkage is constrained by the displacer blocks, use of the lever lock may result in damage to bellows joints or flexure.

2. If the displacer cannot be blocked because of cage configuration or other concerns, the transmitter is uncoupled from the torque tube by loosening the coupling nut, and the access handle will be in the locked position. Before placing such a configuration into service, couple the instrument to the sensor as follows:

   To couple the instrument to the sensor:

   a. Slide the access handle to the open position to lock the lever assembly in place and expose the access hole. Press on the back of the handle as shown in figure 2-2 then slide the handle toward the front of the unit. Be sure the locking handle drops into the detent.

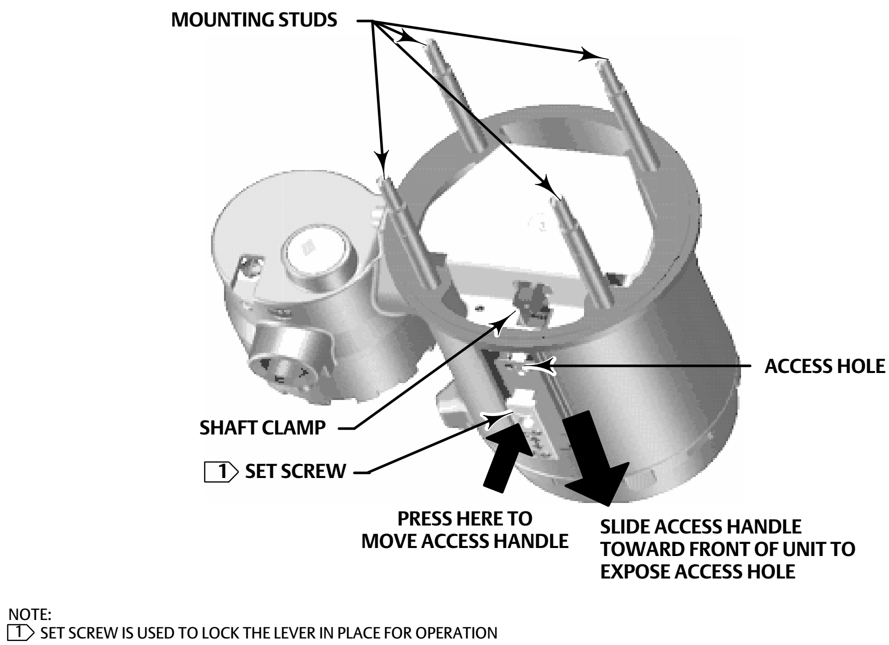
   b. If in process, ensure that the level or interface is in the lowest position on the displacer.

      If on the bench, ensure that the displacer is dry and the displacer rod lever arm is not hitting a travel stop.

   c. Insert a 10 mm deep well socket through the access hole and onto the torque tube shaft clamp nut. Tighten the clamp nut to a maximum torque of 2.1 N•m(18 lbf•in).

   d. Slide the access handle to the closed position. for operation or calibration (Press on the back of the handle as shown in figure 2-2 then slide the handle toward the rear of the unit.) Be sure the locking handle drops into the detent.

Figure 2-2. Sensor Connection Compartment (Adapter Ring Removed for Clarity)



Hazardous Area Classifications and Special Instructions for “Safe Use” and Installation in Hazardous Locations

Refer to the DLC3020f Quick Start Guide (D103470X012) that ships with the instrument for Hazardous Area Classifications and Special Instructions for “Safe Use” and Installations in Hazardous Locations. If a copy of this quick start guide is needed contact your Emerson Process Management sales office or visit our website at www.Fisher.com.

Mounting

WARNING

To avoid personal injury or property damage, always wear protective gloves, clothing, and eyewear when performing any installation operations.

Personal injury or property damage due to sudden release of pressure, contact with hazardous fluid, fire, or explosion can be caused by puncturing, heating, or repairing a displacer that is retaining process pressure or fluid. This danger may not be readily apparent when disassembling the sensor or removing the displacer. Before disassembling the sensor or removing the displacer, observe the appropriate warnings provided in the sensor instruction manual.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

Mounting the 249 Sensor

The 249 sensor is mounted using one of two methods, depending on the specific type of sensor. If the sensor has a caged displacer, it typically mounts on the side of the vessel as shown in figure 2-3. If the sensor has a cageless displacer, the sensor mounts on the side or top of the vessel as shown in figure 2-4.

Figure 2-3. Typical Caged Sensor Mounting

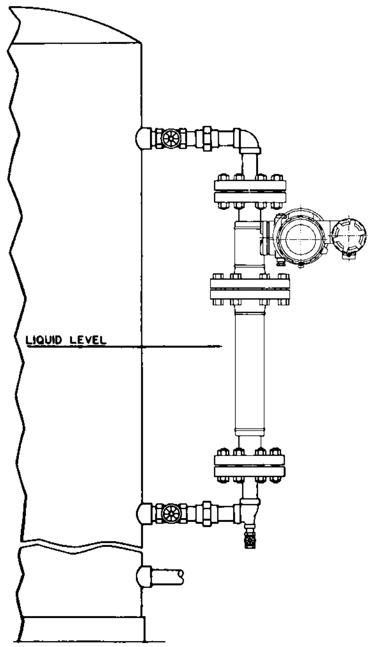


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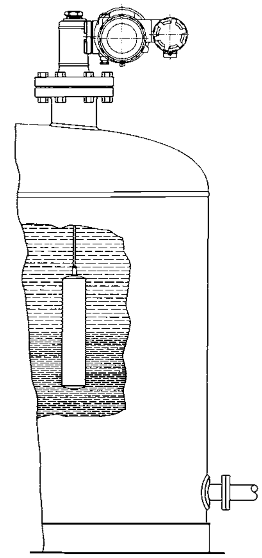
Figure 2-4. Typical Cageless Sensor Mounting



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The DLC3020f digital level controller is typically shipped attached to the sensor. If ordered separately, it may be convenient to mount the digital level controller to the sensor and perform the initial setup and calibration before installing the sensor on the vessel.

Note

Caged sensors have a rod and block installed on each end of the displacer to protect the displacer in shipping. Remove these parts before installing the sensor to allow the displacer to function properly.

DLC3020f Orientation

Mount the DLC3020f with the torque tube shaft clamp access hole (see figure 2-2) pointing downward to allow accumulated moisture drainage.

Note

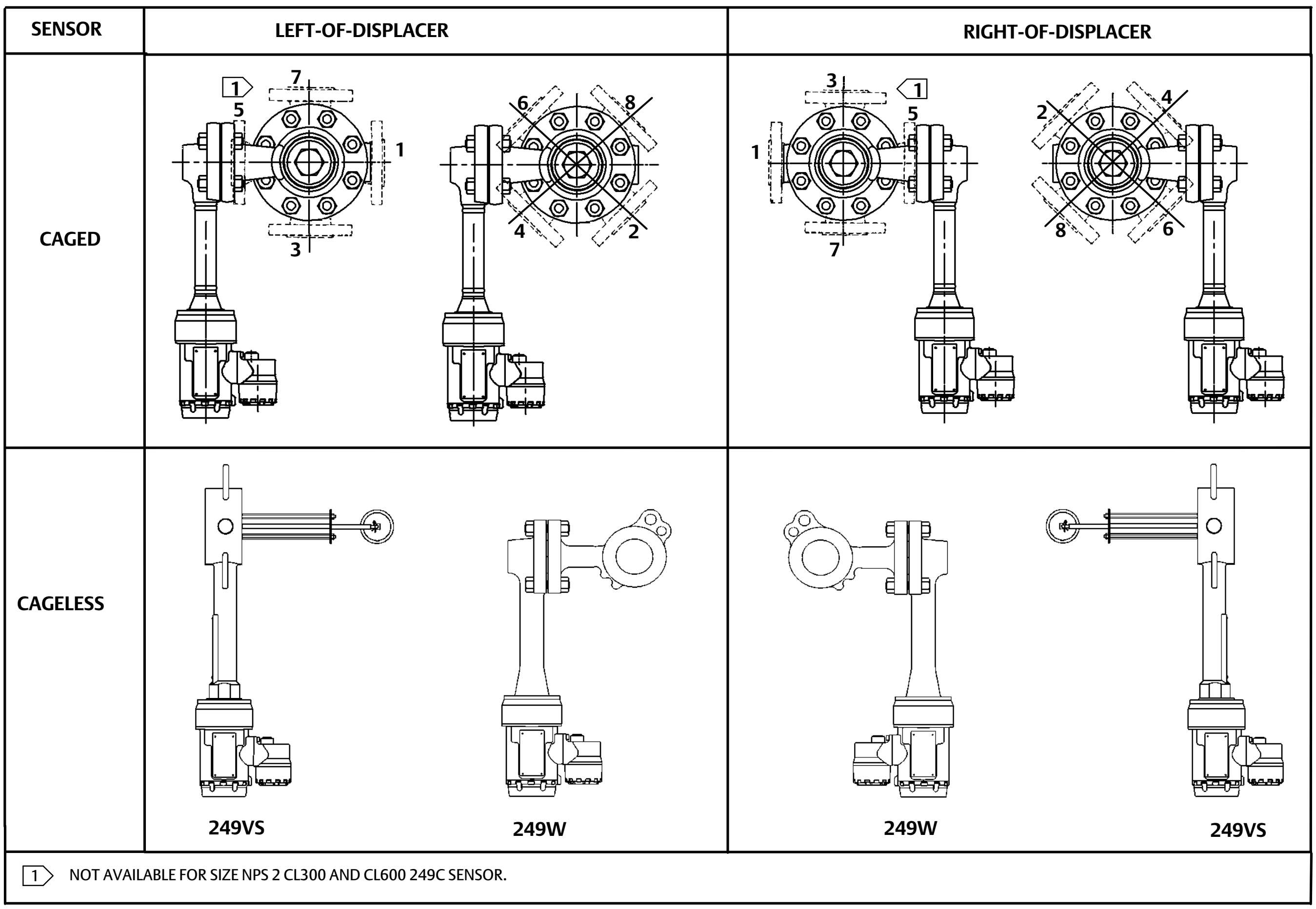
If alternate drainage is provided by the user, and a small performance loss is acceptable, the instrument could be mounted in 90 degree rotational increments around the pilot shaft axis. The LCD meter may be rotated in 90 degree increments to accommodate this.

The digital level controller and torque tube arm are attached to the sensor either to the left or right of the displacer, as shown in figure 2-5. This can be changed in the field on the 249 sensors (refer to the appropriate sensor instruction

manual). Changing the mounting also changes the effective action, because the torque tube rotation for increasing level, (looking at the protruding shaft), is clockwise when the unit is mounted to the right of the displacer and counter-clockwise when the unit is mounted to the left of the displacer.

All 249 caged sensors have a rotatable head. That is, the digital level controller can be positioned at any of eight alternate positions around the cage as indicated by the position numbers 1 through 8 in figure 2-5. To rotate the head, remove the head flange bolts and nuts and position the head as desired.

Figure 2-5. Typical Mounting Positions for the FIELDVUE DLC3020f Digital Level Controller on a Fisher 249 Sensor

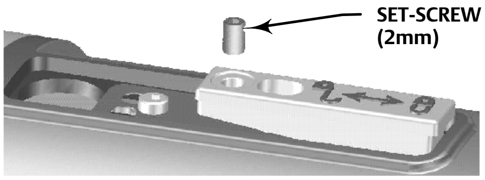


Mounting the DLC3020f on a 249 Sensor

Refer to figure 2-2 unless otherwise indicated.

1. If the set-screw in the access handle, (see figure 2-6) is driven against the spring plate, back it out until the head is flush with the outer surface of the handle, using a 2 mm hex key. Slide the access handle to the open position to lock the lever assembly in place and to expose the access hole. Press on the back of the handle as shown in figure 2-2 then slide the handle toward the front of the unit. Be sure the locking handle drops into the detent.

Figure 2-6. Close-up of Set-Screw



2. Using a 10 mm deep well socket inserted through the access hole, loosen the shaft clamp (figure 2-2).
3. Remove the hex nuts from the mounting studs. Do not remove the adapter ring.

CAUTION

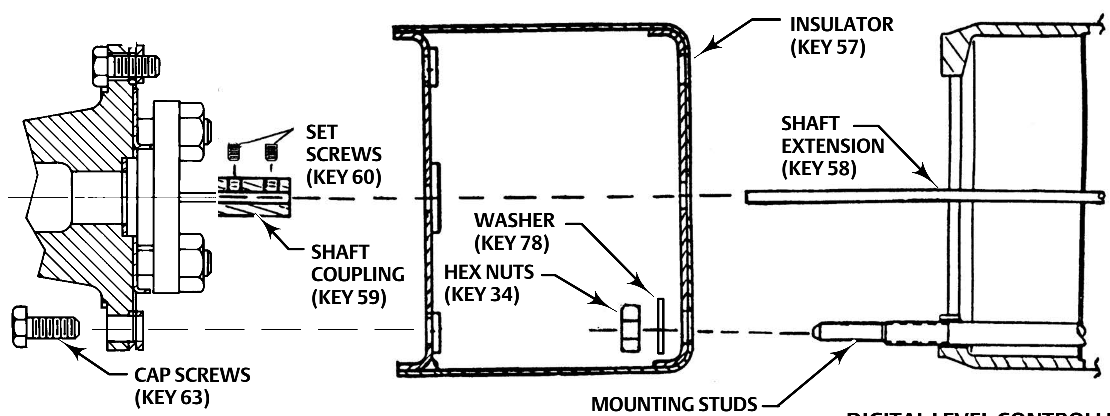
Measurement errors can occur if the torque tube assembly is bent or misaligned during installation.

4. Position the digital level controller so the access hole is on the bottom of the instrument.
5. Carefully slide the mounting studs into the sensor mounting holes until the digital level controller is snug against the sensor mounting flange.
6. Reinstall the hex nuts on the mounting studs and tighten the hex nuts to 10 N•m (88.5 lbf•in).

Mounting the DLC3020f for High Temperature Applications

Refer to figure 2-7 for parts identification except where otherwise indicated.

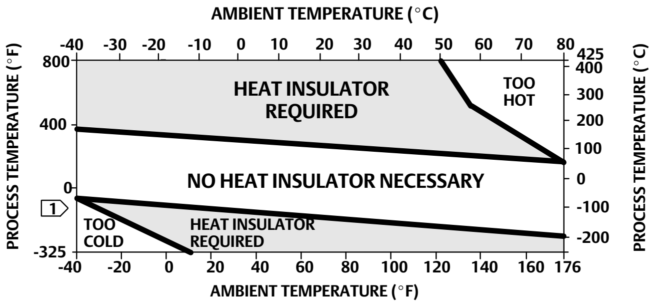
Figure 2-7. Digital Level Controller Mounting on Sensor in High Temperature Applications



The digital level controller requires an insulator assembly when temperatures exceed the limits shown in figure 2-8.

A torque tube shaft extension is required for a 249 sensor when using an insulator assembly.

Figure 2-8. Guidelines for Use of Optional Heat Insulator Assembly



STANDARD TRANSMITTER

NOTES:
1 FOR PROCESS TEMPERATURES BELOW -29°C (-20°F) AND ABOVE 204°C (400°F) SENSOR MATERIALS MUST BE APPROPRIATE FOR THE PROCESS - SEE TABLE 1-4.
2. IF AMBIENT DEW POINT IS ABOVE PROCESS TEMPERATURE, ICE FORMATION MIGHT CAUSE INSTRUMENT MALFUNCTION AND REDUCE INSULATOR EFFECTIVENESS.

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A5494-1

CAUTION

Measurement errors can occur if the torque tube assembly is bent or misaligned during installation.

1. When mounting a DLC3020f on a 249 sensor, secure the shaft extension to the sensor torque tube shaft via the shaft coupling and set screws, with the coupling centered as shown in figure 2-7.
2. Slide the access handle to the locked position to expose the access hole. Press on the back of the handle as shown in figure 2-2 then slide the handle toward the front of the unit. Be sure the locking handle drops into the detent.
3. Remove the hex nuts from the mounting studs.
4. Position the insulator on the digital level controller, sliding the insulator straight over the mounting studs.
5. Install 4 washers (key 78) over the studs. Install the four hex nuts and tighten.
6. Carefully slide the digital level controller with the attached insulator over the shaft coupling so that the access hole is on the bottom of the digital level controller.
7. Secure the digital level controller and insulator to the torque tube arm with four cap screws.
8. Tighten the cap screws to 10 N•m (88.5 lbf•in).

Electrical Connections

The following describes how to make fieldbus connections to the digital level controller. For information on connecting a simulate jumper, refer to page 19.

⚠ WARNING

To avoid personal injury resulting from electrical shock, do not exceed the maximum input voltage specified in table 1-2 or on the product nameplate. If the input voltage specified differs, do not exceed the lowest specified maximum input voltage.

⚠ WARNING

Select wiring and/or cable glands that are rated for the environment of use (such as hazardous area, ingress protection and temperature). Failure to use properly rated wiring and/or cable glands can result in personal injury or property damage from fire or explosion.

Wiring connections must be in accordance with local, regional, and national codes for any given hazardous area approval. Failure to follow the local, regional, and national codes could result in personal injury or property damage from fire or explosion.

Personal injury or property damage caused by fire or explosion may occur if this connection is attempted in a potentially explosive atmosphere or in an area that has been classified as hazardous. Confirm that area classification and atmosphere conditions permit the safe removal of the terminal box cover before proceeding

Fieldbus Connections

The digital level controller is normally powered over the bus from a fieldbus 9 to 32 volt power supply and can be connected to the segment using field wiring. Refer to the site preparation guide for proper wire types, termination, length, etc. for a fieldbus segment.

Note

As shipped from the factory, the DLC3020f will have the transducer block mode set Out of Service. See the Configuration Section for information on setup and calibration and placing the instrument in service. The initial value for all blocks are shown in the parameter list for each block in the Blocks section.

Refer to figure 8-1 for identification of parts.

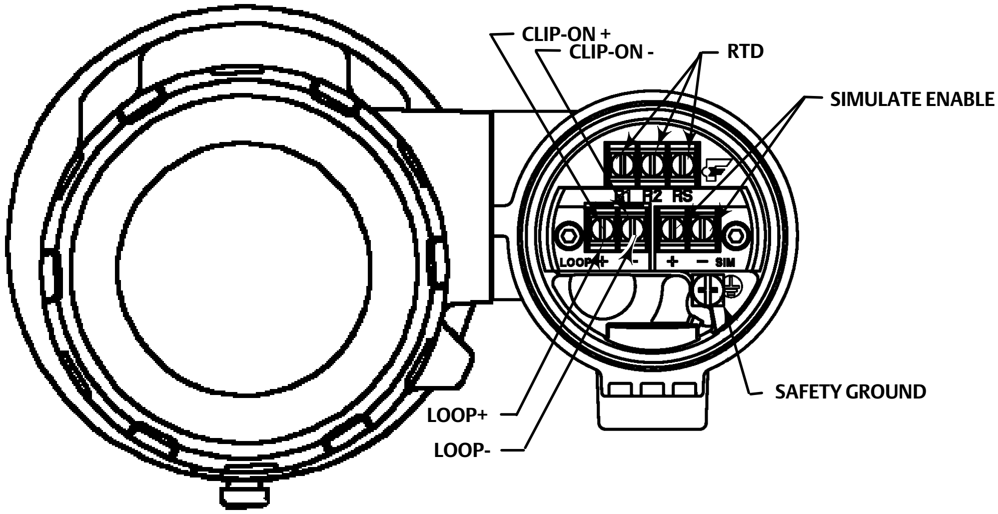
1. Remove the terminal box cover (key 6) from the terminal box (key 5).
2. Bring the field wiring into the terminal box. When applicable, install conduit using local and national electrical codes which apply to the application.
3. Connect one wire from the control system output card to the LOOP + terminal in the terminal box as shown in figure 2-9. Connect the other wire from the control system output card to the LOOP - terminal. The instrument is not polarity sensitive.

⚠ WARNING

Personal injury or property damage, caused by fire or explosion, can result from the discharge of static electricity. Connect a 14 AWG (2.08 mm^2) ground strap between the digital level controller and earth ground when flammable or hazardous gases are present. Refer to national and local codes and standards for grounding requirements.

4. As shown in figure 2-9, ground terminals are available for connecting a safety ground, earth ground, or drain wire. The safety ground terminal is electrically identical to the earth ground. Make connections to these terminals following national and local codes and plant standards.
5. Replace and tighten the terminal box cover, ensuring that it is weather-tight; engage the optional set-screw lock if required.

Figure 2-9. Terminal Box Assembly



Communication Connections

⚠ WARNING

Personal injury or property damage caused by fire or explosion may occur if this connection is attempted in a potentially explosive atmosphere or in an area that has been classified as hazardous. Confirm that area classification and atmosphere conditions permit the safe removal of the terminal box cap before proceeding.

Note

Host system device manager interfaces, such as Emerson's AMS Device Manager or the Field Communicator, communicate directly with the device.

A FOUNDATION fieldbus communicating device, such as a Field Communicator, interfaces with the DLC3020f from any wiring termination point in the segment. If you choose to connect the fieldbus communicating device directly to the instrument, attach the device to the LOOP + / - clip-on connections inside the terminal box to provide local communications with the instrument.

Simulate Enable Jumper

⚠ WARNING

Personal injury or property damage caused by fire or explosion may occur if this connection is attempted in a potentially explosive atmosphere or in an area that has been classified as hazardous. Confirm that area classification and atmosphere conditions permit the safe removal of the terminal box cap before proceeding.

Install a jumper across the SIMULATE ENABLE terminals to enable the instrument to accept a simulate command. (These terminals are marked SIM + / - in the terminal box, as shown in figure 2-9). With the jumper in place and the simulate software parameter set to enabled, various alerts can be simulated as required.

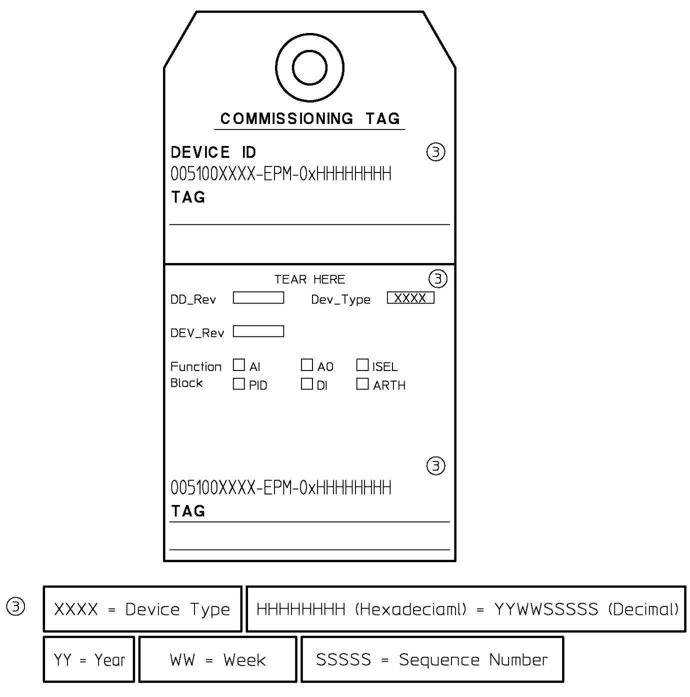
Note

Removing the jumper will disable the simulate, which may change the status of PV.

Commissioning Tag

The DLC3020f is supplied with a removable paper commissioning tag, shown in figure 2-10. This tag contains both the device ID and a space to record the device's tag number. The device ID is a unique code that identifies a particular device in the absence of a device tag. The device tag is used as an operational identification for the device and is usually defined by the piping and instrumentation diagram (P&ID).

Figure 2-10. Paper Commissioning Tag



When commissioning more than one device on a fieldbus segment, identifying which device is at a particular location can be tedious without tags. The removable tag provided with the digital level controller can be used to link the device ID and the physical installation location. The installer should note the physical location in both places on the removable commissioning tag and tear off the bottom portion. This should be done for each device on the segment. The bottom portion of the tags can be used for commissioning the segment in the control system.

Prior to commissioning, the device ID is displayed by the host system if no device tag is configured in the digital level controller electronics. Typically the placeholder displays the device tag. The information on the paper tag enables the engineer to match the device ID to the correct placeholder.

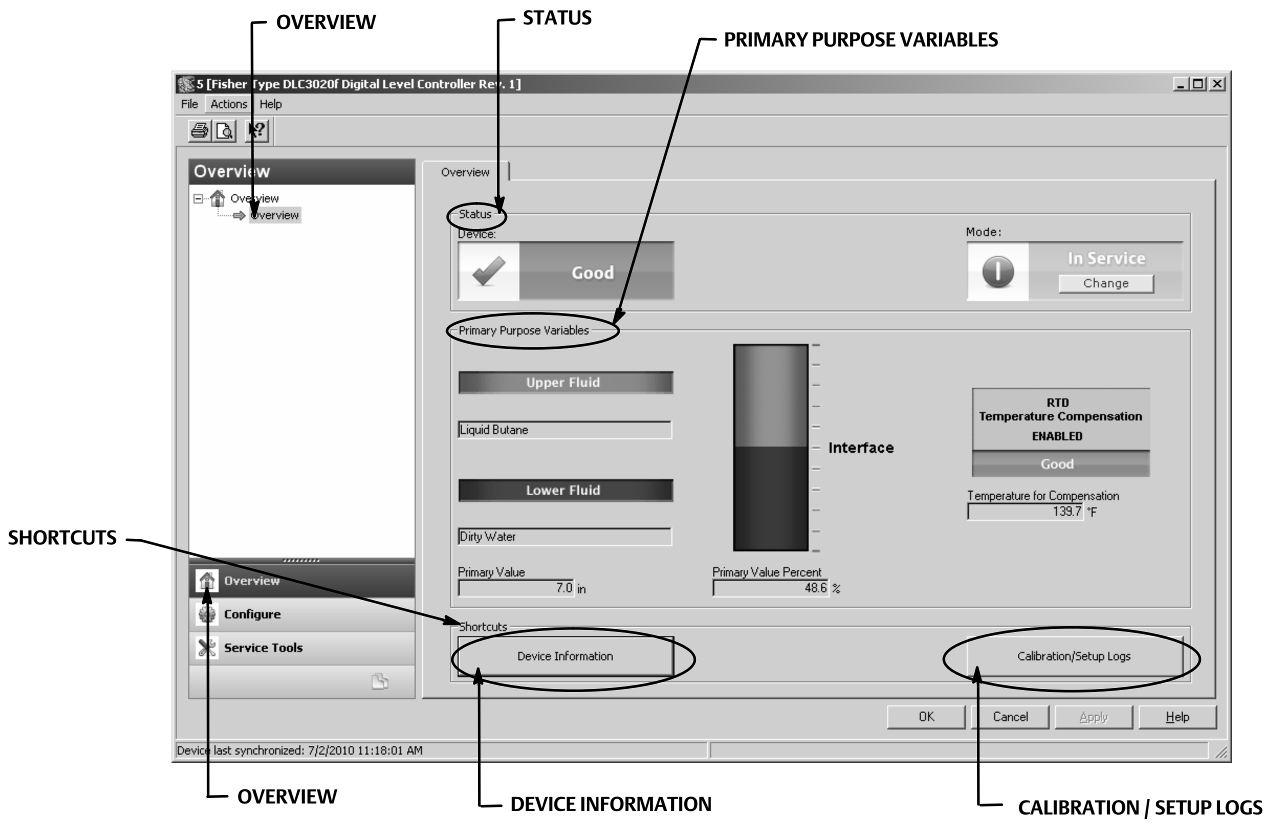
Section 3 Overview

Overview

AMS Device Manager	Overview > Overview
Field Communicator	Overview > Overview

Select the Overview tab (figure 3-1) to access *Overview* and *Shortcuts*.

Figure 3-1. Overview



Overview

Status

Device

Good there are no active alerts and instrument is In Service

Failed a configured failed alert is active

Maintenance a configured maintenance alert is active and a configured failed alert is turned on

Advisory a configured advisory alert is active and configured failed or a maintenance alert is turned on

Mode

In Service the instrument is in service

Not in Service the instrument is not in service

Primary Purpose Variables

Depending on your application, the primary purpose variables found on Overview may include the following:

Fluid (Fluid for Level measurement, Upper Fluid and Lower Fluid or Interface measurement, when enabled).

Primary Value

Primary Value Percent

Temperature for Compensation (when enabled)

Type of Measurement (Level or Interface)

Shortcuts

Device Information

Device Overview

- Instrument Model Number
- Instrument Serial Number

Version Information

Version information contains information that is stored within the instrument.

- Device Revision
- Firmware Revision
- Hardware Revision
- Major Sensor Revision
- Minor Sensor Revision
- DD Information

Manufacturing Identification

Each instrument has a unique Device Identifier. The device identification provides in depth manufacturing data to help ensure reliability.

- Lever Assembly ID
- Communication Module ID
- Sensor Module ID
- Shop Order Number
- Terminal Box Date Code

Calibration/Setup Logs

Logs including calibration, instrument setup, and process fluid data can be saved for future reference or re-use. The instrument can store up to 30 logs.

- Calibration in Use

  Name

  Date

  Calibration Method

  Calibrator

- Calibration/Setup Logs

  View—select *View* to access stored logs.

  Restore—select *Restore* to access stored logs; select the desired log to revert back to.

  Save Current—select *Save Current* and enter a new name.

  Rename—select *Rename* to change the name of an existing log.

  Delete—select *Delete* to delete to delete an existing log.

- Mode—indicates whether the instrument is In Service or Not In Service.

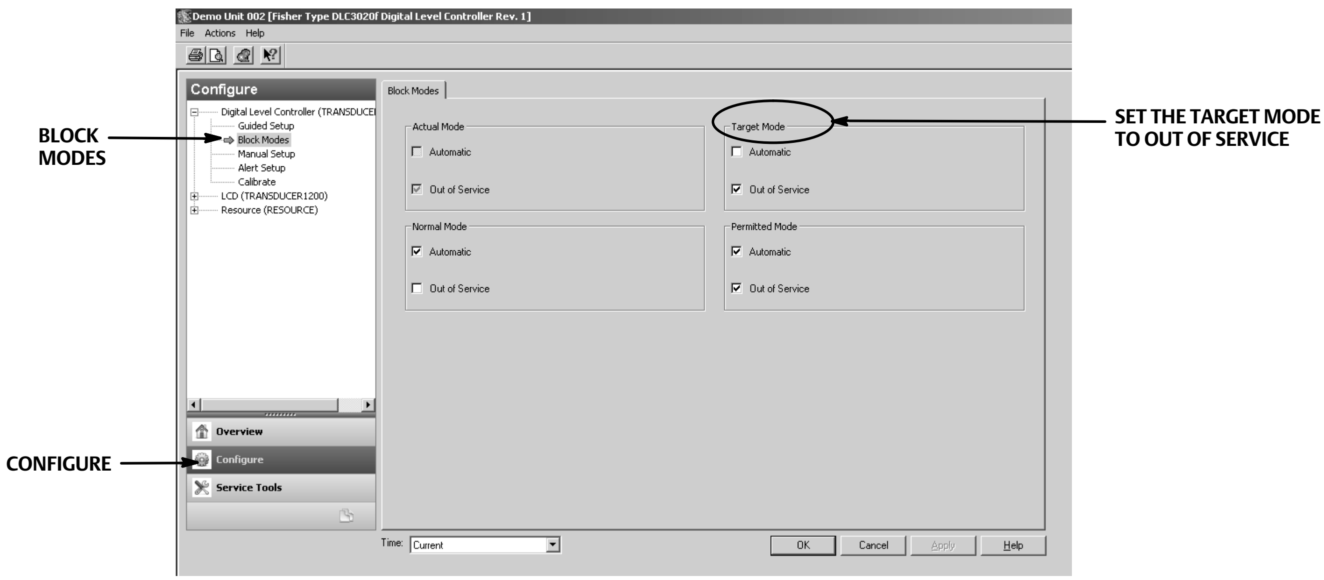
Section 4 Configuration

Note

The primary transducer block must be set to out of service before the device can be configured.

When using AMS Device Manager 10.1 and earlier go to Target Mode in Block Modes tab to set the primary transducer block in and out of service. Refer to figure 4-1.

Figure 4-1. Block Modes Tab (AMS Device Manager 10.1 and earlier)

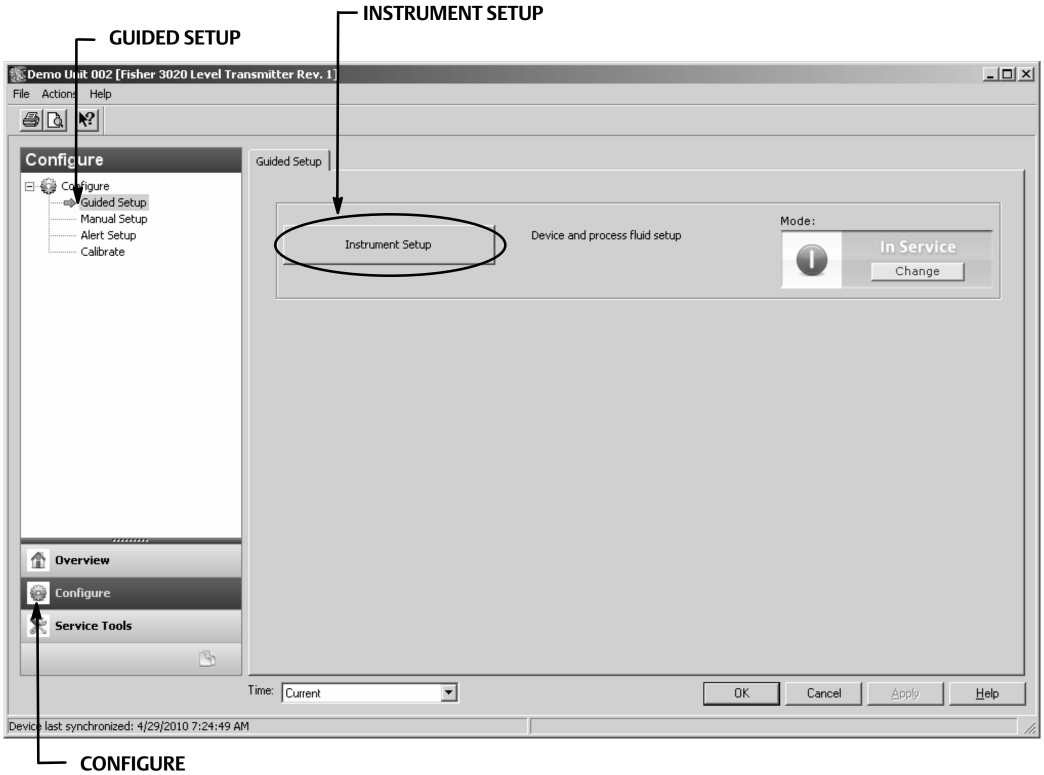


Guided Setup

AMS Device Manager	Configure > Guided Setup
Field Communicator	Configure > Instrument Setup

Access *Instrument Setup* from the Guided Setup tab, as shown in figure 4-2, for sensor, device and process fluid setup. Follow the prompts to setup the DLC3020f.

Figure 4-2. Guided Setup



Manual Setup

AMS Device Manager	Configure > Manual Setup
Field Communicator	Configure > Manual Setup

The *Device*, *Process Fluid*, *Instrument Display*, *Snap Acting Control*, and *Options* tabs are accessible through Manual Setup.

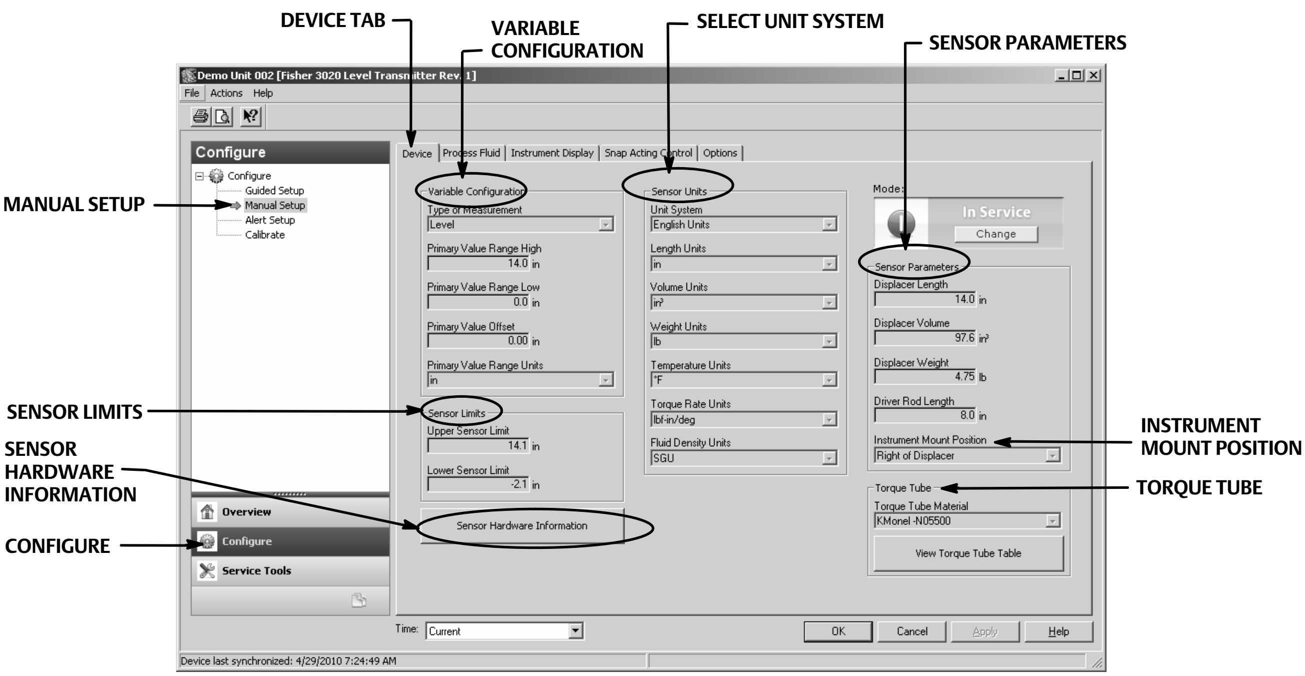
Note

An error will be generated if the instrument is put back in service without applying device configuration changes; you must apply changes before putting the instrument back In Service. To clear an error, set the Mode to Out of Service, select Apply, then put back In Service.

Device

Select the Device tab (figure 4-3) to access *Variable Configuration*, *Sensor Limits*, *Sensor Hardware Information*, *Sensor Units*, *Mode*, *Sensor Parameters*, *Instrument Mount Position,* and *Torque Tube.*

Figure 4-3. Configure > Manual Setup > Device



Variable Configuration

Type of Measurement— Level or Interface

Primary Value Range High— defines the maximum operational end point for reported PV.

Primary Value Range Low— defines the minimum operational end point for reported PV. Default is above zero.

Primary Value Offset— the constant offset applied to the level/interface measurement.

Primary Value Range Units— units for PV, PV Range, and Sensor Limits.

Sensor Limits

Upper Sensor Limit— Indicates the maximum usable value for the Primary Value Range High.

Lower Sensor Limit— Indicates the minimum usable value for the Primary Value Range Low.

The Upper and Lower Sensor Limit limit what the DLC3020ft can read; values above and below these limits will not be detected by the instrument. This is a dynamic reading based on temperature used when Temperature Compensation is enabled.

Sensor Hardware Information

Enter the following information by selecting *Sensor Hardware Information.*

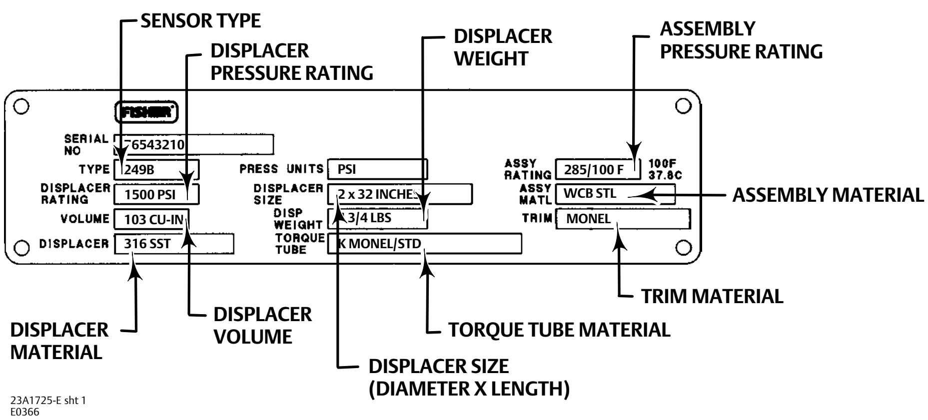
Model Type, End Connection Style, End Connection Type, Body Material, Pressure Rating, Mechanical Sensor Serial Number, Displacer Size Displacer Material, Displacer Rating, G Dimension, Torque Tube Material, Torque Tube Wall, Heat Insulator.

Sensor information is typically found on the sensor nameplate, as shown in figure 4-4.

Note

This data is informational only and is not used in calibration or PV calculations.

Figure 4-4. Typical Sensor Nameplate



Sensor Units

Select the appropriate sensor units for your application.

Note

Default units from factory are SI (Metric).

If you choose Mixed Units you must select the units for each sensor parameter.

Unit System—English Units, Metric/SI Units, Mixed Units

Length Units—mm, cm, m, in, or ft

Volume Units—mm^3, ml, L, in^3

Weight Units—oz, lb, g, or kg

Temperature Units—°F, °R, °C, or K

Torque Rate Units—N•m/deg, dyne•cm/deg, lbf•in/deg

Fluid Density Units—degAPI, SGU (Specific Gravity) lb/in^3, lb/ft^3, lb/gal, degBaum hv, degBaum lt, kg/m^3, g/cm^3, kg/L, g/ml, or g/L

Sensor Parameters

Enter the sensor parameters. Selections shown in the drop down are based on the sensor units chosen.

Displacer Length

Displacer Volume

Displacer Weight

Driver Rod Length

Note

Table 4-1 provides the driver rod length of 249 sensors with vertical displacers. If your sensor isn't included in table 4-1 refer to figure 4-5 to determine the driver rod length.

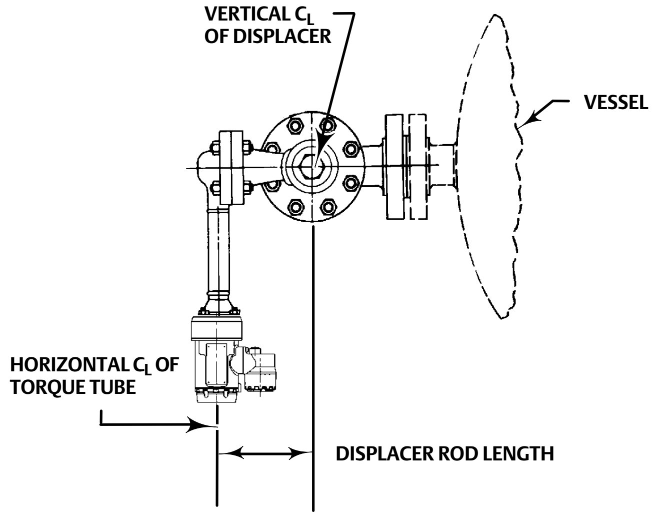
Instrument Mount Position

Table 4-1. Driver Rod Length(1)

SENSOR TYPE(2)	DRIVER ROD	
	mm	INCH
249	203	8.01
249B	203	8.01
249BF	203	8.01
249BP	203	8.01
249C	169	6.64
249CP	169	6.64
249K	267	10.5
249L	229	9.01
249N	267	10.5
249P (CL125-CL600)	203	8.01
249P (CL900-CL2500)	229	9.01
249V (Special)(1)(3)	See serial card	See serial card
249V (Std)(3)	343	13.5
249VS	343	13.5
249W	203	8.01

1. Driver rod length is the perpendicular distance between the vertical centerline of the displacer and the horizontal centerline of the torque tube. See figure 4-5. If you cannot determine the driver rod length, contact your Emerson Process Management sales office and provide the serial number of the sensor.
2. This table applies to sensors with vertical displacers only. For sensor types not listed, or sensors with horizontal displacers, contact your Emerson Process Management sales office for the driver rod length. For other manufacturers' sensors, see the installation instructions for that mounting.
3. The 249V is only available in Europe.

Figure 4-5. Method of Determining Driver Rod Length from External Measurements



Torque Tube

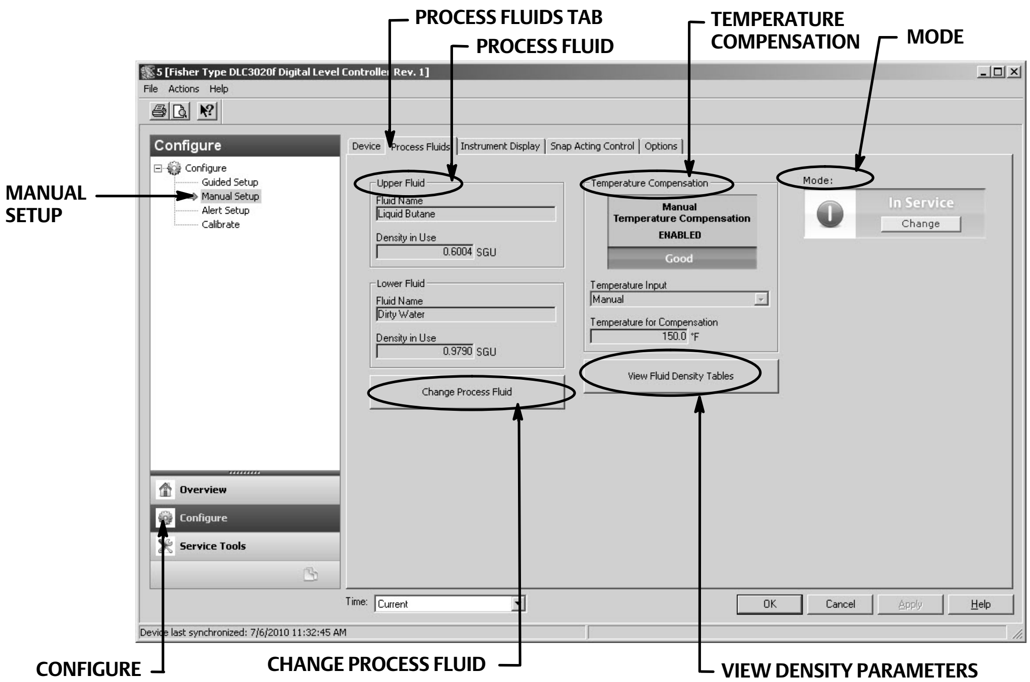
Torque Tube Material—select the material of the torque tube being used. See the sensor nameplate.

View Torque Tube Table—select View Torque Tube Table to see the torque tube gain over the entire temperature range and the compensated torque rate.

Process Fluid

Select the Process Fluid tab (figure 4-6) to access *Process Fluid*, *Temperature Compensation*, and *Mode*.

Figure 4-6. Configure > Manual Setup > Process Fluid



Note

The instrument software contains density tables for common categories of fluids. Custom tables can be built if needed.

Some fluid categories have wide variations within fluid types. Select the fluid category and then the fluid type.

Input the operating process temperature and the density. The DLC3020f will load the density table that best matches the fluid type at operating conditions.

Process Fluid

Fluid Name

Density In Use

Change Process Fluid —Select Change Process Fluid to begin the process to properly select the corrections for density of the fluid that occur at operational temperature.

If Temperature Compensation is selected, the proper density table for use in temperature compensation is selected. If Temperature Compensation is not needed, enter the operating conditions and name the fluid.

Temperature Compensation

If Temperature Compensation is selected, provide the following information:

Temperature Input—select None, Manual, AO Block, or RTD.

Temperature compensation, when enabled, can come from a manually entered temperature, a temperature from a fieldbus transmitter (AO block) or a temperature from an RTD.

Temperature for Compensation—the temperature in use for fluid density and torque tube material compensation.

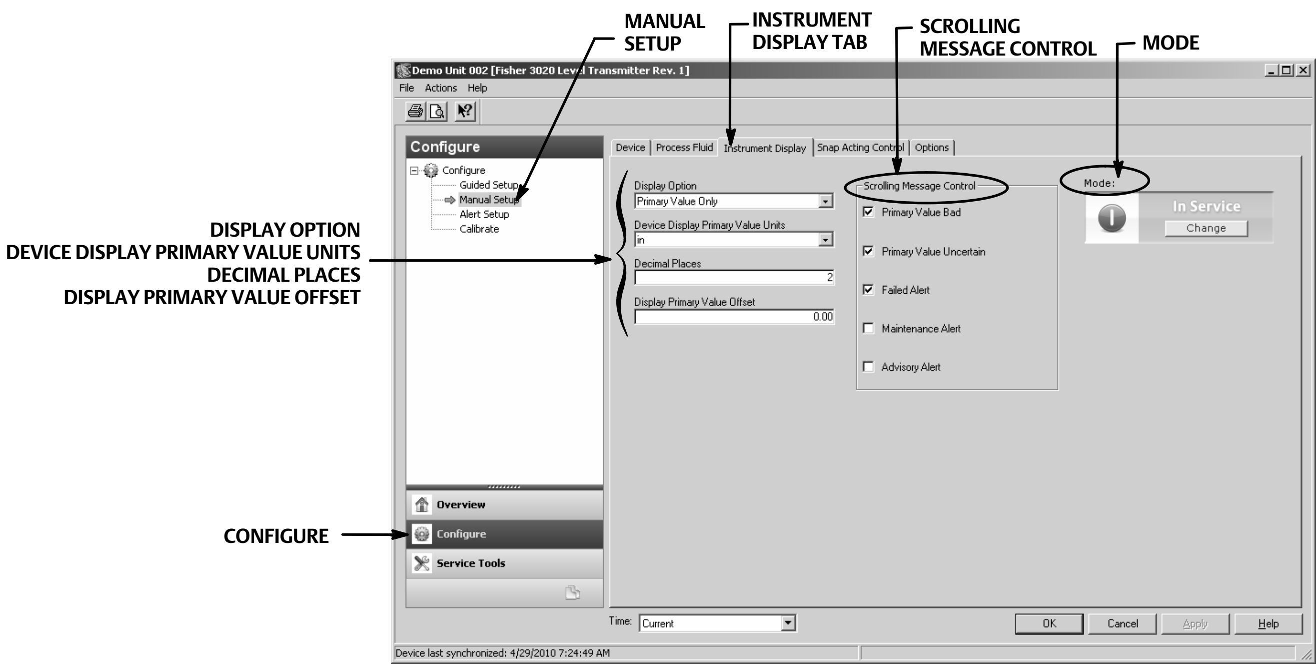
View Fluid Density Table

Select View Fluid Density Table to see information concerning the temperature effect on process fluid density.

Instrument Display

Select the Instrument Display tab (figure 4-7) to access *Display Option, Device Display Primary Value Units*, *Decimal Places*, *Display Primary Value Offset,* and *Scrolling Message Control.*

Figure 4-7. Configure > Manual Setup > Instrument Display



Display Option

Select Primary Value Only, % Range, or Primary Value / % Range to be displayed on the DLC3020f LCD.

Device Display Primary Value Units

Select the units for the device display Primary Value.

Decimal Places

Enter the number of desired decimal places for the device display.

Display Primary Value Offset

Enter the PV Offset to apply it to the LCD readout.

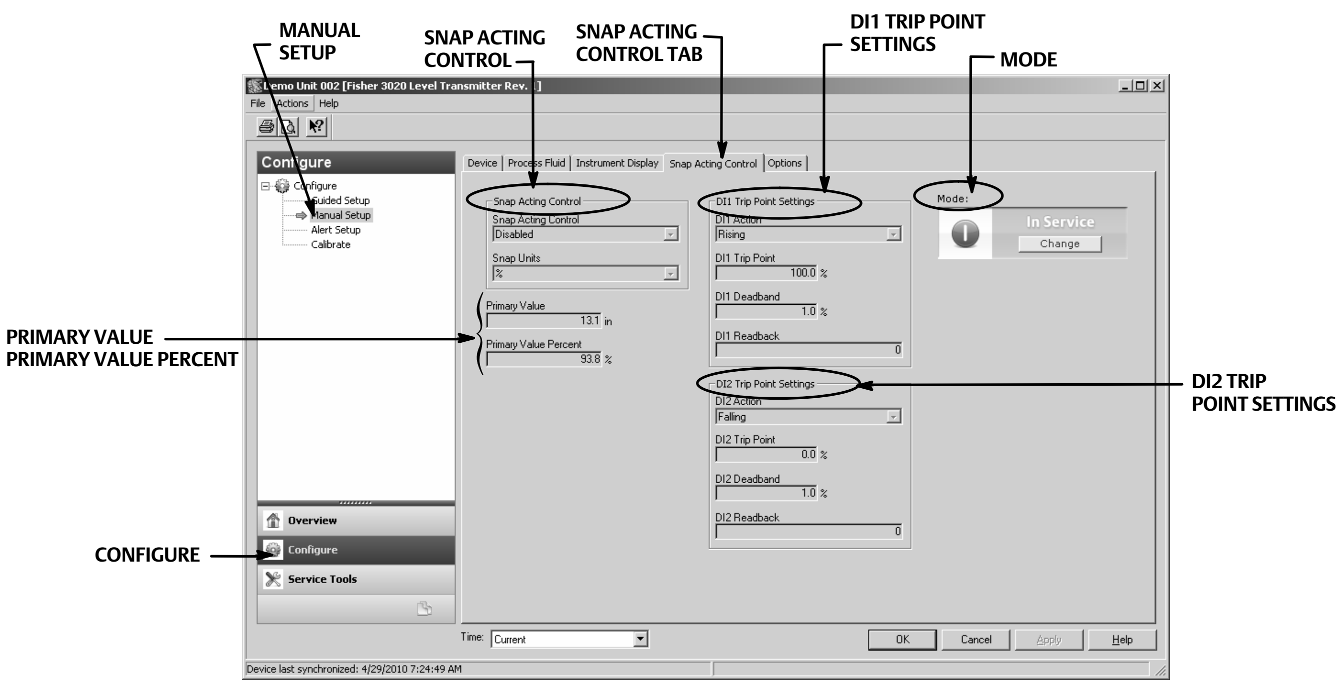
Scrolling Message Control

Messages that can be scrolled on the LCD screen. Choose from; Primary Value Bad, Primary Value Uncertain, Failed Alert, Maintenance Alert, or Advisory Alert.

Snap Acting Control

Select the Snap Acting Control tab (figure 4-8) to access *Snap Acting Control*, *Primary Value*, *Primary Value Percent*, *DI1 Trip Point Settings*, *DI2 Trip Point Settings*, and *Mode.*

Figure 4-8. Configure > Manual Setup > Snap Acting Control



Snap Acting Control

The DLC3020f can act as a snap acting controller while simultaneously reporting PV. When Snap Acting Control is enabled, either one or both of the DI blocks will act as controllers and output a 0 (inactive) or 1 (active), depending on if the level has gone past (either rising or falling) a user specified level value.

Snap Acting Control—enable or disable Snap Acting Control.

Snap Units—select the desired snap unit in engineering units; length units or percent (%).

Primary Value

PV in engineering units

Primary Value Percent

PV in %

DI1 Trip Point Settings

Set Channel 1 or 2 of the DI for snap acting control.

DI1 Action—indicate whether the trip point is active on *rising* or *falling* level.

DI1 Trip Point—enter the point where DI1 is active.

DI1 Deadband—enter the desired deadband. This is the distance away from the trip point that DI1 clears.

DI1 Readback—indicates the status of the trip point. 0 indicates that DI1 Trip is inactive. 1 indicates DI1 Trip is active.

DI2 Trip Point Settings

DI2 Action—indicate whether the trip point is active on *rising* or *falling* level.

DI2 Trip Point—enter the point where DI2 is active.

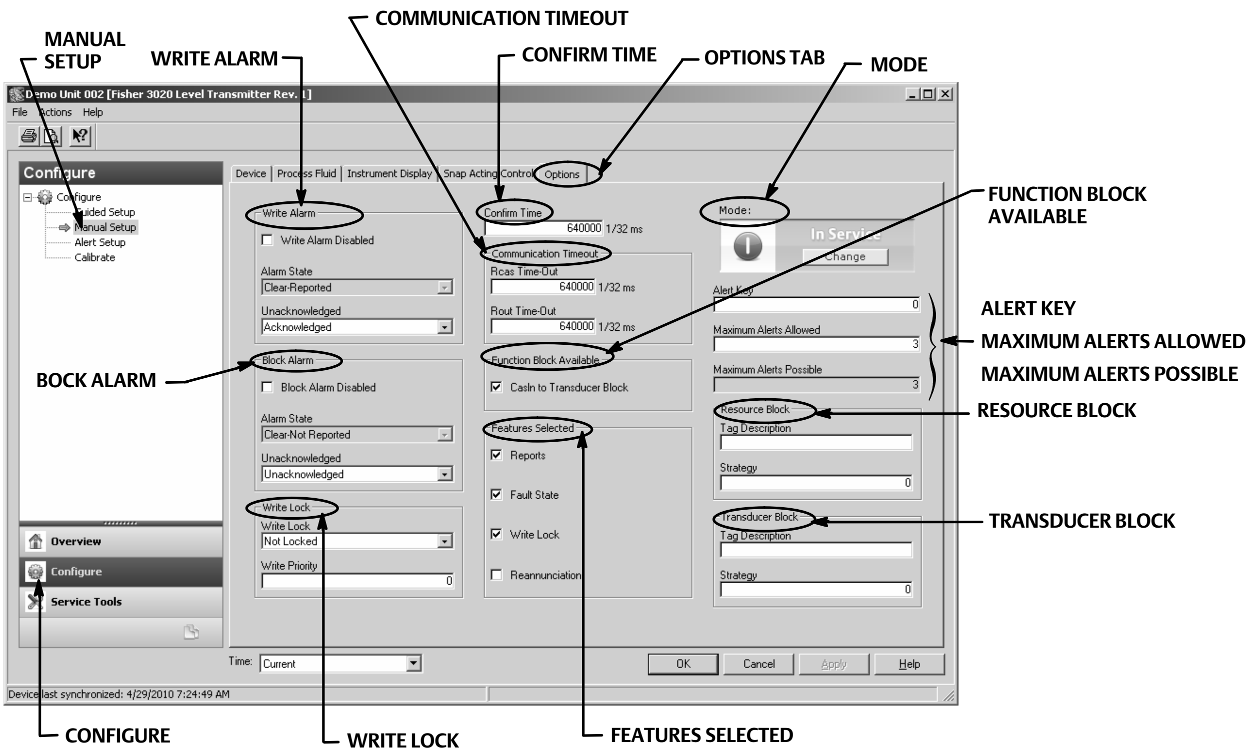
DI2 Deadband—enter the desired deadband. This is the distance away from the trip point that DI2 clears.

DI2 Readback—indicates the status of the trip point. 0 indicates that DI2 Trip is inactive. 1 indicates DI2 Trip is active.

Options

Select the Options tab (figure 4-9) to access *Write Alarm*, *Block Alarm*, *Write Lock*, *Confirm Time*, *Communication Timeout*, *Function Block Available*, *Features Selected*, *Alert Key*, *Maximum Alerts Allowed*, *Maximum Alerts Possible*, *Resource Block*, *Transducer Block,* and *Mode.*

Figure 4-9. Configure > Manual Setup > Options



Write Alarm

The Write Alarm (WRITE_ALM [40]) is used to alert when parameters are writable to the device.

Write Alarm Disabled—select to disable the Write Alarm

Alarm State—indicates the state of the Write Alarm. Five states are possible; Undefined, Clear-Reported, Clear-Not Reported, Active-Reported, Active-Not Reported.

Unacknowledged—select Undefined, Acknowledged, or Unacknowledged

Block Alarm

The block alarm is used for all configuration, hardware, connection failure, or system problems in the block. Alarm Summary (ALARM_SUM [37]) determines if the Write Alarm and Block Alarm are disabled.

Block Alarm Disabled—select to disable the Block Alarm

Alarm State—indicates the state of the Block Alarm. Five states are possible; Undefined, Clear-Reported, Clear-Not Reported, Active-Reported, Active-Not Reported.

Unacknowledged—select Undefined, Acknowledged, or Unacknowledged

Write Lock

Write Lock determines if writes are permissible to other device parameters.

Write Lock— When Write Lock is set to Locked, no writes are permitted to any parameters within the device except to set Write Lock to Not Locked. When locked, the device functions normally, updating inputs and outputs and executing algorithms. When Write Lock is set to Not Locked, the Write Alarm alert is active.

Write Priority—Write Priority sets the priority for Write Alarm. The lowest priority is 0. The highest is 15.

Confirm Time

Confirm Time determines the time in 1/32 of a millisecond, the instrument waits for confirmation of receipt of a report before trying again. If Confirm Time is 0, the instrument does not try to resend the report. Enter 0 or a value between 320000 (10 seconds) and 640000 (20 seconds).

Communication Timeout

Note

Typically this parameter does not need to be changed. The unit will be operational using the default values assigned by the factory. Perform this procedure only if a remote computer is sending setpoints from your “advanced” control.

Default value for RCas Timeout is 20 seconds.

Rcas Time-Out—Rcas Timeout determines how long function blocks in the DLC3020f should wait before giving up on remote computer writes to RCas parameters. When the timeout is exceeded, the block sheds to the next mode as defined by the block shed options. If RCas Timeout is set to 0, the block will not shed from RCas. Enter a positive value in the RCas Timeout Timeout field. Time duration is in 1/32 milliseconds (640000 = 20 secs).

Note

Typically this parameter does not need to be changed. The unit will be operational using the default values assigned by the factory. Perform this procedure only if a remote computer is sending setpoints from your “advanced” control.

Default value for ROut Timeout is 20 seconds.

Rout Time-Out—ROut Timeout (SHED_ROUT [27]) determine how long function blocks in the DLC3020f should wait before giving up on computer writes to ROut parameters. When the timeout is exceeded, the block sheds to the next mode as defined by the block shed options. If ROut Timeout is set to 0, the block will not shed from ROut. Enter a positive value in the ROut Timeout field. Time duration is in 1/32 milliseconds (640000 = 20 secs).

Write Lock—permits using Write Lock to prevent any external change to parameter values. Block connections and calculation results will proceed normally, but the configuration is locked.

Reannunciation—permits the instrument to support Reannunciation of alarms.

Function Block Available

CasIn to Transducer Block

Features Selected

Note

Typically this parameter does not need to be changed. The unit will be operational using the default values assigned by the factory.

Features Selected indicates which Resource Block Options features have been selected and is used to select the desired features.

Reports—Selecting reports enables alert and event reporting. Reporting of specific alerts may be suppressed.

Fault State—Selecting Fault State enables the ability of the output block to react to various abnormal conditions by shedding mode.

Write Lock—When selected, permits using Write Lock to prevent any external change to parameter values. Block connections and calculation results will proceed normally, but the configuration is locked.

Reannunciation— When selected, the instrument will support Reannunciation of alarms.

Alert Key

Alert Key is a number that permits grouping alerts. This number may be used to indicate to the operator the source of the alert, such as the instrument, plant unit, etc. Enter a value between 1 and 255.

Maximum Alerts Allowed

The number of alert reports that the device can send without getting a confirmation up to the maximum permitted

Resource Block

Tag Description— The Tag Description is used to assign a unique 32 character description to each block within the digital level controller to describe the intended application of the block.

Strategy— Strategy permits strategic grouping of blocks so the operator can identify where the block is located. The blocks may be grouped by plant area, plant equipment, etc. Enter a value between 0 and 65535 in the Strategy field.

Transducer Block

Tag Description— The Tag Description is a 32 character description used to assign a unique description to each block within the digital level controller to describe the intended application for the block.

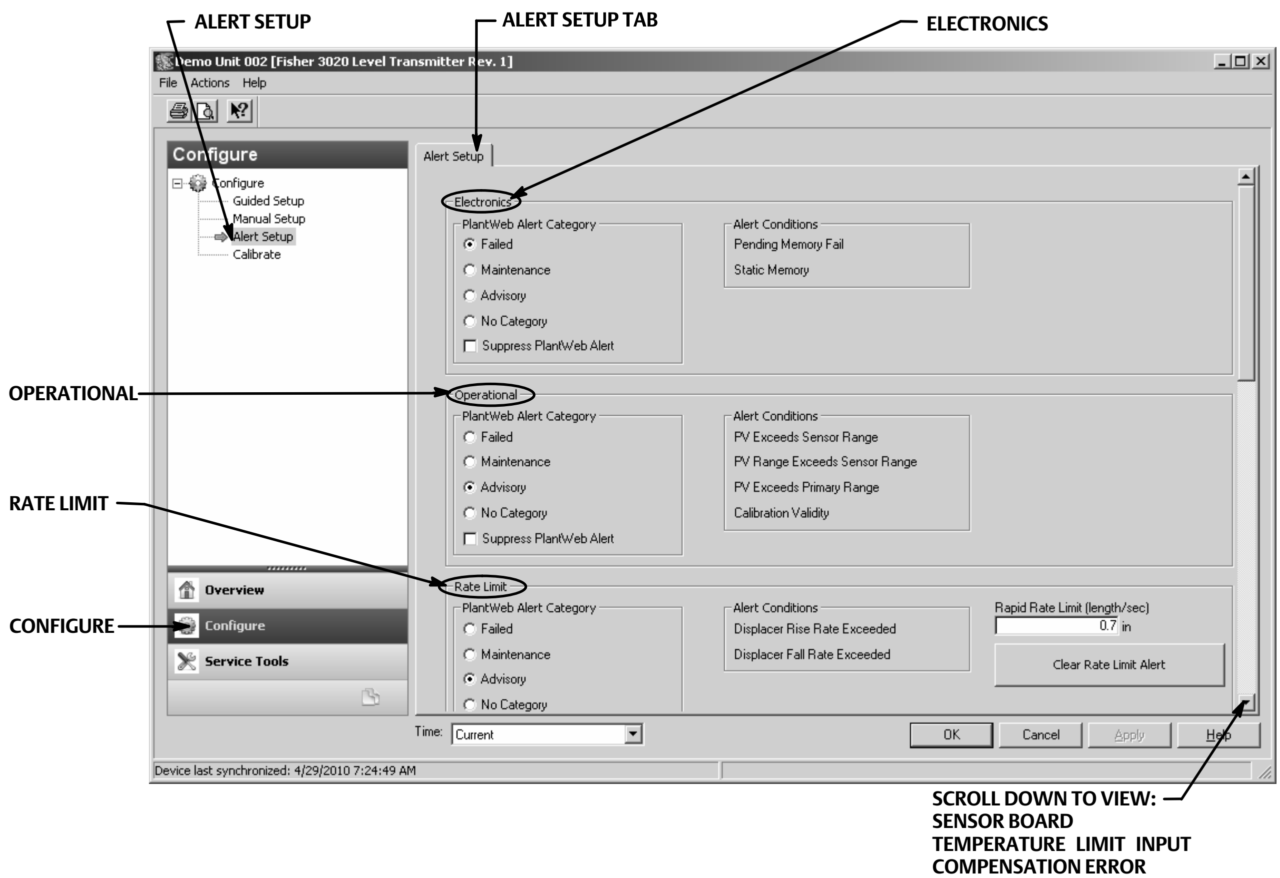
Strategy— Strategy permits strategic grouping of blocks so the operator can identify where the block is located. The blocks may be grouped by plant area, plant equipment, etc. Enter a value between 0 and 65535 in the Strategy field.

Alert Setup

AMS Device Manager	Configure > Alert Setup
Field Communicator	Configure > Alert Setup

Alert Setup is accessible through the Alert Setup tab (figure 4-10).

Figure 4-10. Alert Setup



Alerts

The DLC3020f provides two levels of alerts; Instrument alerts and PlantWeb alerts.

Instrument Alert Conditions

Instrument Alert Conditions, when enabled, detect many operational and performance issues that may be of interest. To view these alerts, the user must open the appropriate status screen on a host such as AMS Device Manager or a Field Communicator.

PlantWeb Alerts

Instrument alert conditions can be used to trigger PlantWeb alerts that will be reported in Failed, Maintenance or Advisory categories, as configured by the user. PlantWeb alerts, when enabled, can participate in the DeltaV™ alarm interface tools such as the alarm banner, alarm list and alarm summary.

When a PlantWeb alert occurs, the DLC3020f sends an event notification and waits a specified period of time for an acknowledgment to be received. This occurs even if the condition that caused the alert no longer exists. If the acknowledgment is not received within the pre-specified time-out period, the event notification is retransmitted. This reduces the possibility of alert messages getting lost.

DLC3020f alerts can be reported in the following categories.

Failed— indicates a problem with the DLC3020f that affects its operation. Immediate action is required for a Failed condition.

Maintenance— indicates a problem with the DLC3020f that, if ignored, could eventually lead to its failure. Maintenance conditions require prompt action.

Advisory— indicates a minor problem with the DLC3020f. An advisory condition does not have an impact on the process or device.

No Category— the alert has not been categorized.

Suppress PlantWeb Alert—- the alert is still evaluated by the DLC3020f, but, it does not report the status condition through an instrument alert.

Electronics

- **Pending Memory Fail**— when selected indicates if a pending memory error has been detected in the main board.
- **Static Memory Fail**— when selected indicates if a memory error has been detected in the main board.

Operational

- **PV Exceeds Sensor Range**— when selected indicates if the Primary Variable (PV) has reached or exceeded the Sensor Range and is no longer correct.
- **PV Range Exceeds Sensor Range**— when selected indicates if the Primary Variable (PV) Range has exceeded the range of the sensor's current calibration. The PV is still accurate but could move out of sensor range.
- **PV Exceeds Primary Range**— when selected indicates if the the Primary Variable (PV) has exceeded the PV Range.
- **Calibration Validity**— when selected indicates if a vital calibration parameter has been changed.

Rate Limit

- **Displacer Rise Rate Exceeded**— when selected indicates if the device detected a rise rate that exceeded the Rapid Rate Limit.
- **Displacer Fall Rate Exceeded Alert**— when selected indicates if the device detected a fall rate that exceeded the Rapid Rate Limit.

Rapid Rate Limit—when selected, triggers an alarm when the configured set point has been exceeded. Rapid rate limit is user-configured based on application.

Select *Clear Rate Limit Alert* to clear the alert.

RTD Sensor

- **RTD Sensor**—when selected indicates if the RTD readings are out of range or the RTD is incorrectly connected.
- **RTD Open**—when selected indicates if the RTD is not connected.

Sensor Board

- **Instrument Temperature Sensor**— when selected indicates if the electronic sensor readings are out of range.
- **Sensor Board Processor**— when selected indicates if the device cannot communicate properly or other electronic problem is effecting the processor.
- **Hall Sensor**— when selected indicates if the Hall Sensor readings are out of range.

Temperature Limit

- **Instrument Temperature High**— when selected indicates if the device has exceeded the Instrument Temperature High Limit.
- **Instrument Temperature Low**— when selected indicates if the device has exceeded the Instrument Temperature Low Limit.

Input Compensation Error

- **Temperature Input Error**— when selected indicates if the AO temperature status or RTD status has become “Bad" or “Uncertain" or the device is not set up correctly to receive AO temperature.
- **Upper Fluid Input Error**— when selected indicates if the Upper Fluid AO status has become “Bad" or “Uncertain" or the device is not setup correctly to receive AO density for the Upper Fluid.
- **Lower Fluid Input Error**— when selected indicates if the Lower Fluid AO status has become “Bad" or “Uncertain" or the device is not setup correctly to receive AO density for the Lower Fluid.
- **Fluid Values Crossed**— when selected indicates if the process fluid density values have crossed; the Upper Fluid density is too close to (0.1 SG), or has become greater than, the Lower Fluid density.
- **Invalid Custom Table**— when selected indicates if the custom process fluid density table or torque tube table being used for temperature compensation is invalid.
- **Temperature Out of Compensation Range**—when selected indicates if the Compensation Temperature has exceeded the compensation limits.

Section 5 Calibration

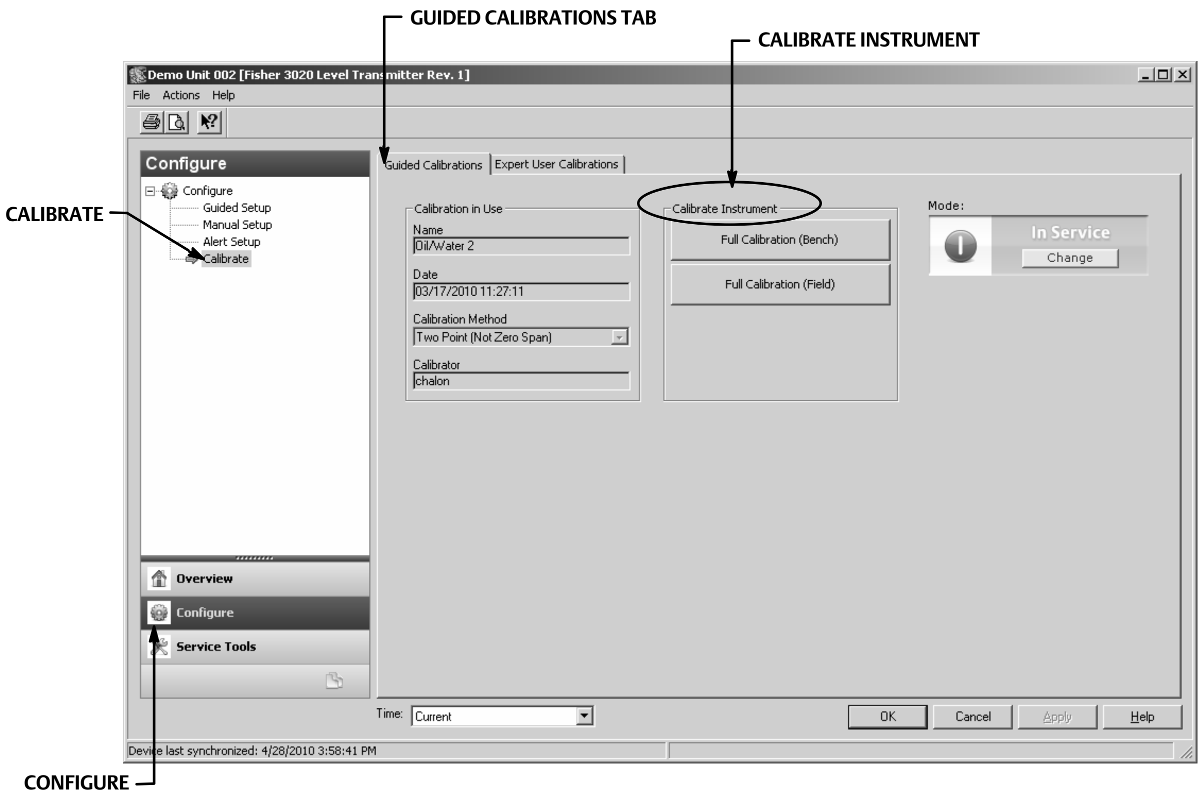
Calibrate

Guided Calibrations

AMS Device Manager	Configure > Calibrate > Guided Calibrations
Field Communicator	Configure > Calibrate > Full Calibration (Bench) or Full Calibration (Field)

Guided Calibrations (figure 5-1) provides access to guided calibration methods for use in the field or on the bench.

Figure 5-1. Guided Calibrations



Calibration in Use

Name—indicates the calibration in use.

Date—indicates when the calibration was performed.

Calibrator—indicates who performed the calibration.

Calibration Method—indicates the method of calibration.

Calibrate Instrument

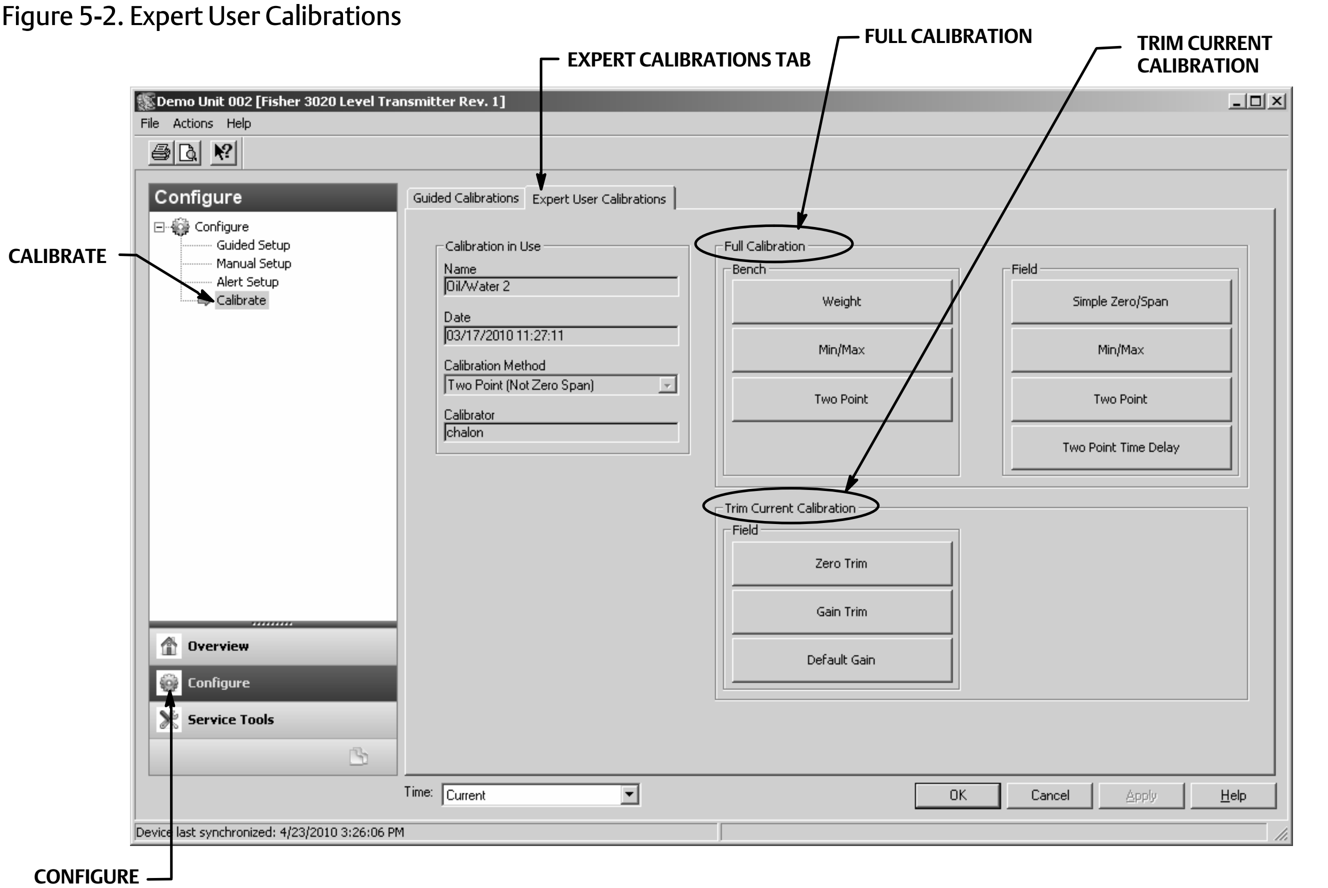
Choose *Full Calibration (Bench)* or *Full Calibration (Field)* and follow AMS Device Manager (or the Field Communicator or other host system) prompts to calibrate the instrument. Guided Calibration recommends an appropriate calibration procedure.

Expert User Calibrations

AMS Device Manager	Configure > Calibrate > Expert User Calibrations
Field Communicator	Configure > Calibrate > Expert User Calibration

Expert User Calibrations (figure 5-2) allows you to select the appropriate calibration based on configuration and available application data. Follow AMS Device Manager (or the Field Communicator or other host system) prompts to calibrate the instrument.

Figure 5-2. Expert User Calibrations



A brief description of available calibrations are included on page 43.

Calibration in Use

Name—indicates the calibration in use.

Date—indicates when the calibration was performed.

Calibrator—indicates who performed the calibration.

Calibration Method—indicates the method of calibration.

Calibration Descriptions

Full Calibration

Weight (Bench only)—Weight Calibration is a bench calibration where weights are used to simulate the different forces the device sees at the minimum and maximum levels. All configuration data is needed to perform a Weight calibration. Weights are suggested based on the current density values so that the two weights closely simulate the minimum and maximum points the device should see, or based on water for certain setups. These are suggested values only; you can enter other values if desired.

Note

The larger the difference in the weights, the better the calibration will be, provided that the unit is not on a mechanical stop.

Note

Ensure that the moment arm is not resting on a travel stop during the calibration process. Also, the weights tend to oscillate when placed on arm, so allow sufficient time for this to dissipate before capturing the points.

When complete, the torque rate or gain will be correct at the calibration temperature. After finalizing the installation a zero trim may be needed since a zero shift may take place when installing the device.

Two Point (Bench or Field)—A Two Point Calibration fully calibrates the device by observing the level/interface at two points. The two points must be at least 5% of the displacer length apart. All instrument configuration data is needed to perform a Two Point calibration. Use this method of calibration when the length/interface can be externally observed.

Min/Max (Bench or Field)—During the Min/Max Calibration torque rate gain and zero are computed by completely submerging the displacer in two different fluids (one of which may be air or vapor). All instrument configuration data is needed to perform a Min/Max calibration and must contain the correct values for displacer volume and driver rod length.

Simple Zero/Span (Field only)— for applications with relatively constant density and temperature conditions. Two points (separated by at least 5% of the displacer length) are captured in this calibration. Only the displacer length is needed to perform the Simple Zero/Span procedure. This calibration does not allow the use of Temperature Compensation.

Note

When using Simple Zero/Span the device cannot be temperature compensated for fluids or torque tube. This calibration should only be used when the temperature and the process density do <u>not</u> change, otherwise an untrimmable error will occur the farther away your process conditions get from the calibrated conditions.

Two Point Time Delay (Field only)—the Two Point Time Delay Calibration is a two point calibration in which the two points captured can be taken some time apart. The first point is captured and stored indefinitely until the second point is captured. All instrument configuration data is needed to perform a Two Point calibration.

Trim Current Calibration

Zero Trim—Zero trim is an adjustment to the current calibration. This adjustment assumes that the current torque rate is correct and the PV error is due to a shift in the zero position.

Gain Trim—Gain trim is an adjustment to the current calibration. This adjustment assumes that the zero point is correct and the PV error is caused by a torque rate change.

Default Gain—Default Gain is an adjustment to the current calibration. This adjustment requires you to set the default gain to the known torque tube rate.

Section 6 Service Tools

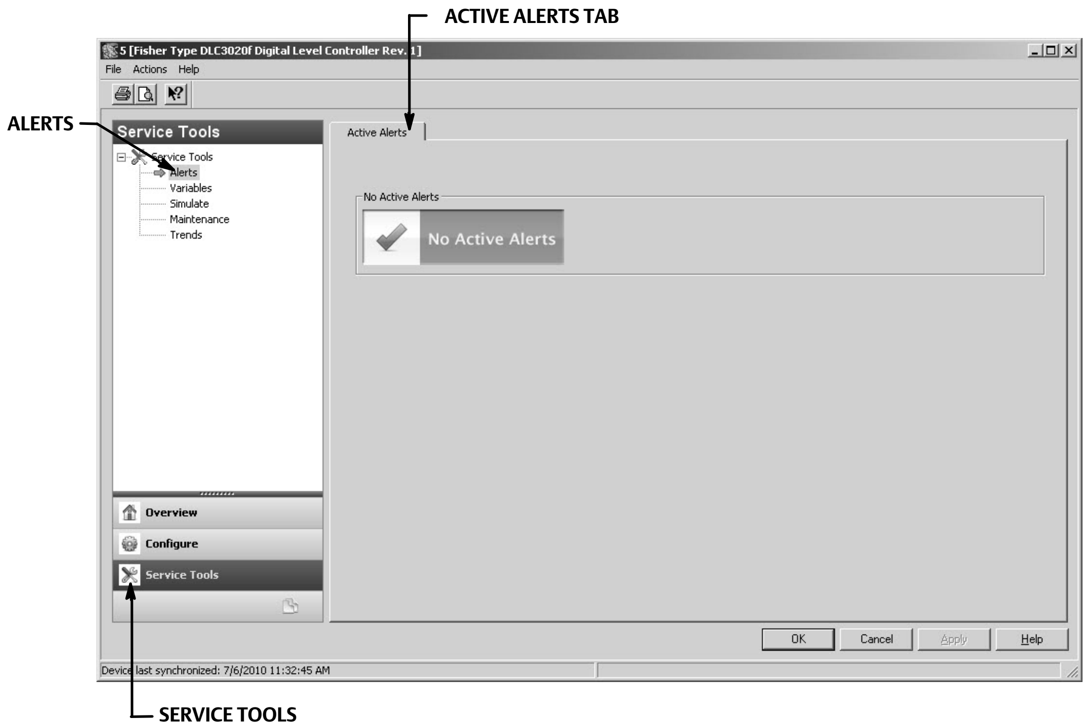
Service Tools

Alerts

AMS Device Manager	Service Tools > Alerts
Field Communicator	Service Tools > Alerts

Active alerts are displayed on the Active Alerts tab (figure 6-1).

Figure 6-1. Service Tools > Alerts



Alert Conditions

The alert conditions for each group of alerts are listed below. If there are no alerts active for a particular group the group will not be displayed in Alerts.

Electronics

- Pending Memory Fail— active if a memory error has been detected in the main board.
- Static Memory Fail— active if a memory error has been detected in the main board.

Operational

- PV Exceeds Sensor Range— active if the Primary Variable (PV) has reached or exceeded the Sensor Range and is no longer correct.

- PV Range Exceeds Sensor Range— active if the Primary Variable (PV) Range has exceeded the range of the sensor's current calibration. The PV is still accurate but could move out of sensor range.
- PV Exceeds Primary Range— active if the The Primary Variable (PV) has exceeded the PV Range.
- Calibration Validity— active if a vital calibration parameter has been changed.

Rate Limit

- Displacer Rise Rate Exceeded— active if the device detected a rise rate that exceeded the Rapid Rate Limit.
- Displacer Fall Rate Exceeded Alert— active if the device detected a fall rate that exceeded the Rapid Rate Limit.

RTD Sensor

- RTD Sensor—active if the RTD readings are out of range or the RTD is incorrectly connected.
- RTD Open—active if the RTD is not connected.

Sensor Board

- Instrument Temperature Sensor— active if the electronic sensor readings are out of range.
- Sensor Board Processor— active if the device cannot communicate properly or other electronic problem is effecting the processor.
- Hall Sensor— active if the Hall Sensor readings are out of range.

Temperature Limit

- Instrument Temperature High— active if the device has exceeded the Instrument Temperature High Limit.
- Instrument Temperature Low— active if the device has exceeded the Instrument Temperature Low Limit.

Input Compensation Error

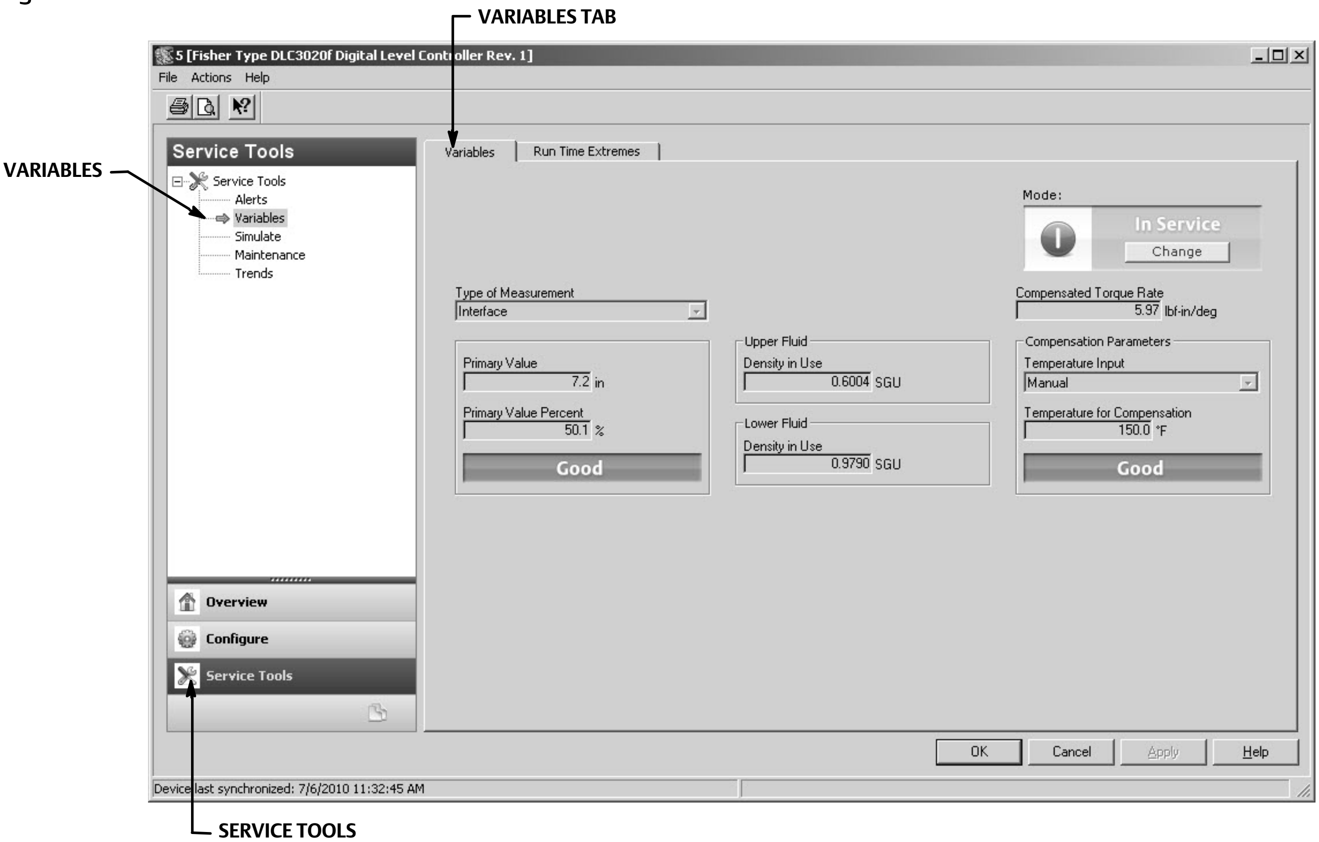
- Temperature Input Error— active if the AO temperature status or RTD status has become “Bad" or “Uncertain" or the device is not set up correctly to receive AO temperature.
- Upper Fluid Input Error— active if the Upper Fluid AO status has become “Bad" or “Uncertain" or the device is not setup correctly to receive AO density for the Upper Fluid.
- Lower Fluid Input Error— active if the Lower Fluid AO status has become “Bad" or “Uncertain" or the device is not setup correctly to receive AO density for the Lower Fluid.
- Fluid Values Crossed— active if the process fluid density values have crossed. The Upper Fluid density has become greater than the Lower Fluid density.
- Invalid Custom Table— active if the custom process fluid density table being used for temperature compensation is invalid.
- Temperature Out of Compensation Range—active if the Compensation Temperature has exceeded the compensation limits.

Variables

AMS Device Manager	Service Tools > Variables
Field Communicator	Service Tools > Variables

Select the Variable tab (figure 6-2) to access *Variables* and *Run Time Extremes*.

Figure 6-2. Service Tools > Variables



Variables

- Type of Measurement
- Primary Value
- Primary Value Percent
- Process Fluid

Density In Use

- Mode
- Compensated Torque Value
- Compensation Parameters

Temperature Input

Temperature for Compensation

Run Time Extremes

- Run Time

- Time Since Reset
- Temperature Limit

Instrument Temperature

- Upper Temperature Limit

Maximum Recorded Temperature

Time Over Upper Temperature Limit

- Lower Temperature Limit

Minimum Recorded Temperature

Time Under Lower Temperature Limit

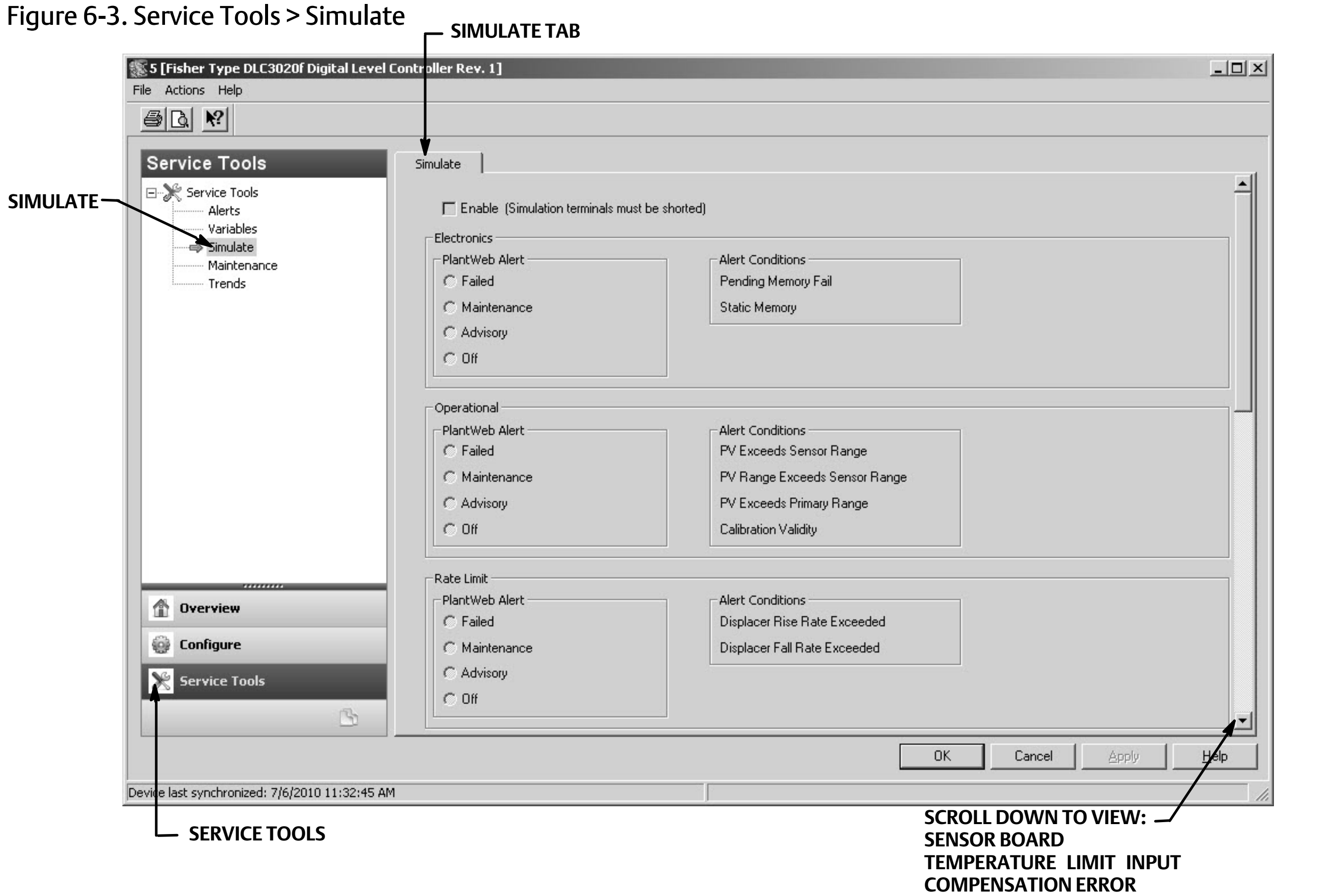
- Temperature Integral

Simulate

AMS Device Manager	Service Tools > Simulate
Field Communicator	Service Tools > Simulate

Simulate (as shown in figure 6-3) is used to validate that user-configured alerts can be transmitted. Refer to Simulate Enable Jumper on page 19 for information on enabling Simulate.

Figure 6-3. Service Tools > Simulate

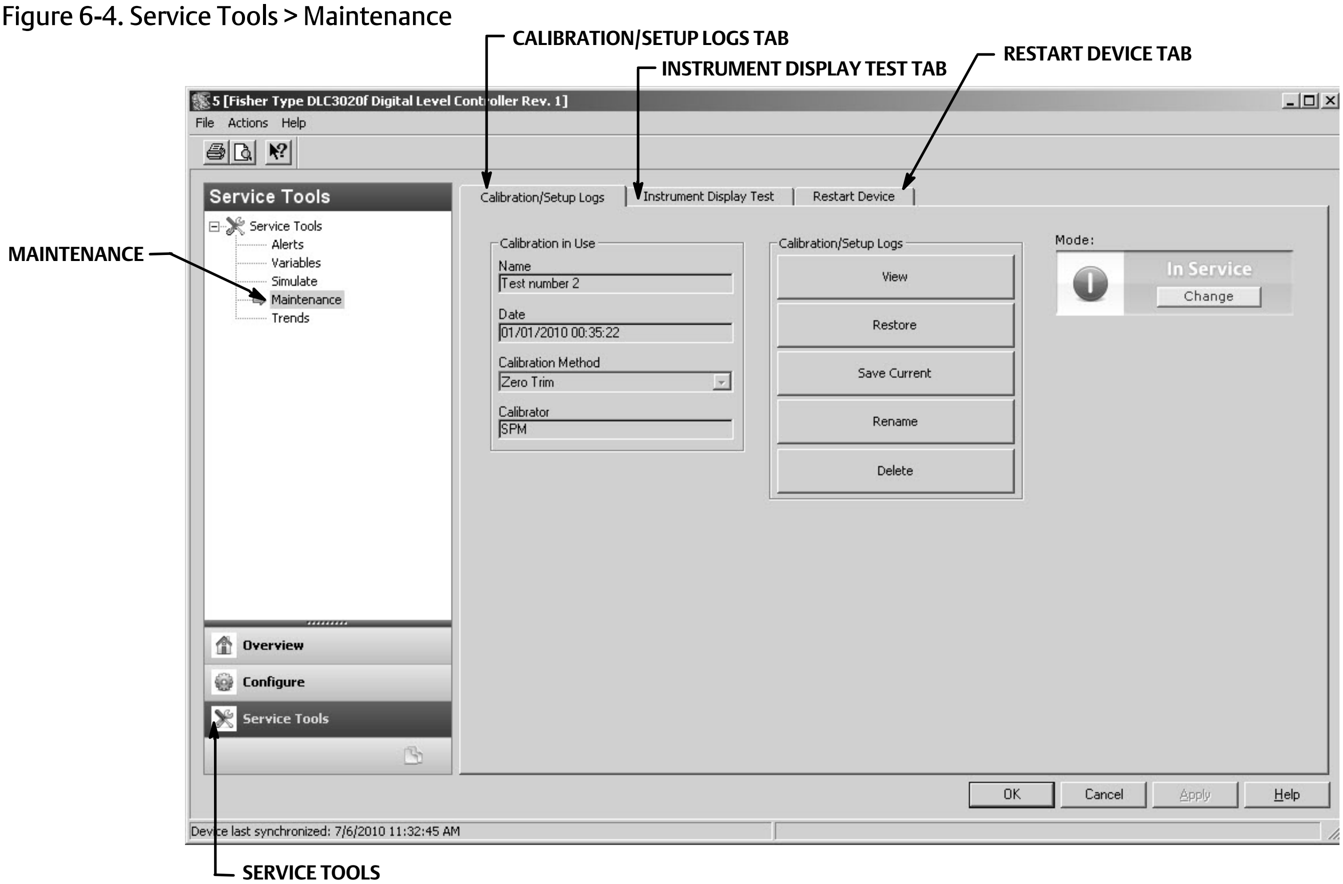


Maintenance

AMS Device Manager	Service Tools > Maintenance
Field Communicator	Service Tools > Maintenance

Calibration Setup/Logs, *Instrument Display Test*, and *Restart Device* are accessible through the Maintenance tab (figure 6-4).

Figure 6-4. Service Tools > Maintenance



Calibration Setup/Logs

- Calibration in Use

Name

Date

Calibration Method

Calibrator

- Calibration/Setup Logs

View—select *View* to access stored logs.

Restore—select *Restore* to access stored logs; select the desired log to revert back to.

Save Current—select *Save Current* and enter a new name.

Rename—select *Rename* to change the name of an existing log.

Delete—select *Delete* to delete to delete an existing log.

- Mode—indicates whether the instrument is In Service or Not In Service.

Instrument Display Test

- Instrument Display Test

Enable/Disable LCD Test

- Device Display Test
- Display Primary Variable
- Display Primary Variable Percent

Restart Device

- Restart

Restart Options; select the desired Restart Action.

Restart Resource resets the static parameters in the resource block to default values.

Restart with Defaults resets ALL static parameters and links in all blocks to default values.

Restart Processor removes and restores power to the DLC3020f.

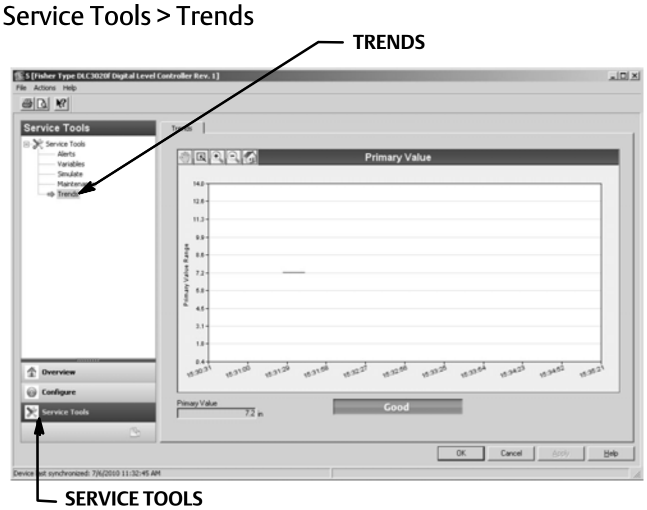
Select *Help* to view information about the above restart methods and *Exit without Restarting* to exit the method.

Trends

AMS Device Manager	Service Tools > Trends

PV trending is accessible through the Trends tab, as shown in figure 6-5. The instrument must be in service and operational to trend PV.

Figure 6-5. Service Tools > Trends



Section 7 Maintenance & Troubleshooting

The DLC3020f digital level controller features modular design for easy maintenance. If you suspect a malfunction, check for an external cause before performing the diagnostics described in this section.

Sensor parts are subject to normal wear and must be inspected and replaced as necessary. For sensor maintenance information, refer to the appropriate sensor instruction manual.

⚠ WARNING

To avoid personal injury or property damage, always wear protective gloves, clothing, and eyewear when performing any maintenance operations.

Personal injury or property damage due to sudden release of pressure, contact with hazardous fluid, fire, or explosion can be caused by puncturing, heating, or repairing a displacer that is retaining process pressure or fluid. This danger may not be readily apparent when disassembling the sensor or removing the displacer. Before disassembling the sensor or removing the displacer, observe the appropriate warnings provided in the sensor instruction manual.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

CAUTION

When replacing components, use only components specified by the factory. Always use proper component replacement techniques, as presented in this manual. Improper techniques or component selection may invalidate the approvals and the product specifications, as indicated in table 1-2. It may also impair operations and the intended function of the device.

Removing the DLC3020f from the Sensor

Because of its modular design, most of the service and maintenance to the digital level controller can be done without removing it from the sensor. However, if necessary to replace sensor to instrument mating parts or parts in the transducer housing, or to perform bench maintenance, perform the following procedures to remove the digital level controller from the sensor.

⚠ WARNING

On an explosion-proof instrument, remove the electrical power before removing the instrument covers in a hazardous area. Personal injury or property damage may result from fire and explosion if power is applied to the instrument with the covers removed.

Tools Required

Table 7-1 lists the tools required for maintaining the DLC3020f digital level controller.

Table 7-1. Tools Required

Tool	Size	Usage	Keys
Hex Key	2 mm	Handle Cover-lock set screws	31 20
Hex Key	2.5 mm	Small cap screws	13
Hex Key	4 mm	Lever assembly mounting cap screw	14
Hex Key	5 mm	Terminal box mounting cap screw	7
Hex Socket	10 mm	Coupling nut	76
Open-end	13 mm	Transmitter mounting nuts	34
Phillips Screwdriver		Terminal screws Electronics module mtg screws	25 36
Small flat blade screwdriver		LCD assembly mounting screws	40
Strap wrench		Helpful for removing a display cover that has been over-tightened	3
Large flat blade screwdriver(1)		Flex circuit mtg screws	19
Needle nose pliers(1)		Align/clamp ring extraction	17

1. Needed to remove a flex circuit if date code numbers are requested for warranty information.

Removing the DLC3020f Digital Level Controller from a 249 Sensor

249 Sensor in Standard Temperature Applications

1. Loosen the set screw (key 31) in the terminal box cover assembly (key 6) so that the cover can be unscrewed from the terminal box.
2. After removing the cover (key 6), note the location of field wiring connections and disconnect the field wiring from the wiring terminals.
3. As shown in figure 2-2, locate the access handle on the bottom of the transducer housing. Using a 2 mm hex key, back out the set screw in the depression on the access handle until it is flush with the handle surface. Press on the back of the handle, as shown in the figure, and slide the handle toward the front of the unit, (the locked position), to expose the access hole. Be sure the locking handle drops into the detent.

Note

If the access handle will not slide, the sensor linkage is most likely in an extreme position. When the lever assembly is at a hard stop inside the housing, the locking pin on the access door may not be able to engage the mating slot in the lever assembly. This condition can occur if the displacer has been removed, if the sensor is lying on its side, or if the instrument had been coupled to the sensor while the displacer was not connected. To correct this condition, manipulate the sensor linkage to bring the lever assembly to within approximately 4 degrees of the neutral position before attempting to slide the handle. A probe inserted through the top vent of the 249 head may be required to deflect the driver rod to a position where the lever assembly is free.

4. Using a 10 mm deep well socket inserted through the access hole, loosen the shaft clamp (figure 2-2).
5. Loosen and remove the hex nuts (key 34) from the mounting studs (key 33).
6. Carefully pull the digital level controller straight off the sensor torque tube.

CAUTION

Tilting the instrument when pulling it off of the sensor torque tube can cause the torque tube shaft to bend. To prevent damage to the torque tube shaft, ensure that the digital level controller is level when pulling it off of the sensor torque tube.

7. When re-installing the digital level controller, follow the appropriate procedure outlined in the Installation section. Also setup the digital level controller as described in the Initial Setup section.

249 Sensor in High Temperature Application

1. Loosen the set screw (key 31) in the terminal box cover assembly (key 6) so that the cover can be unscrewed from the terminal box.
2. After removing the cover (key 6), note the location of field wiring connections and disconnect the field wiring from the wiring terminals.
3. As shown in figure 2-2, locate the access handle on the bottom of the transducer housing. Using a 2 mm hex key, back out the set screw in the depression on the access handle until it is flush with the handle surface. Press on the back of the handle, as shown in the figure, and slide the handle toward the front of the unit, (the locked position), to expose the access hole. Be sure the locking handle drops into the detent.

Note

If the access handle will not slide, the sensor linkage is most likely in an extreme position. When the lever assembly is at a hard stop inside the housing, the locking pin on the access door may not be able to engage the mating slot in the lever assembly. This condition can occur if the displacer has been removed, if the sensor is lying on its side, or if the instrument had been coupled to the sensor while the displacer was not connected. To correct this condition, manipulate the sensor linkage to bring the lever assembly to within approximately 4 degrees of the neutral position before attempting to slide the handle. A probe inserted through the top vent of the 249 head may be required to deflect the driver rod to a position where the lever assembly is free.

4. Using a 10 mm deep well socket inserted through the access hole, loosen the shaft clamp (figure 2-2).
5. While supporting the instrument, loosen and remove the cap screws (key 63).
6. Carefully pull the digital level controller straight off the torque tube shaft extension (key 58).

CAUTION

Tilting the instrument when pulling it off of the sensor torque tube can cause the torque tube shaft to bend. To prevent damage to the torque tube shaft, ensure that the digital level controller is level when pulling it off of the sensor torque tube.

7. Loosen and remove the hex nuts (key 34) from the mounting studs (key 33).
8. Pull the heat insulator (key 57) off the mounting studs.
9. When re-installing the digital level controller, follow the appropriate procedure outlined in the Installation section. Also setup the digital level controller as described in the Setup and Calibration section.

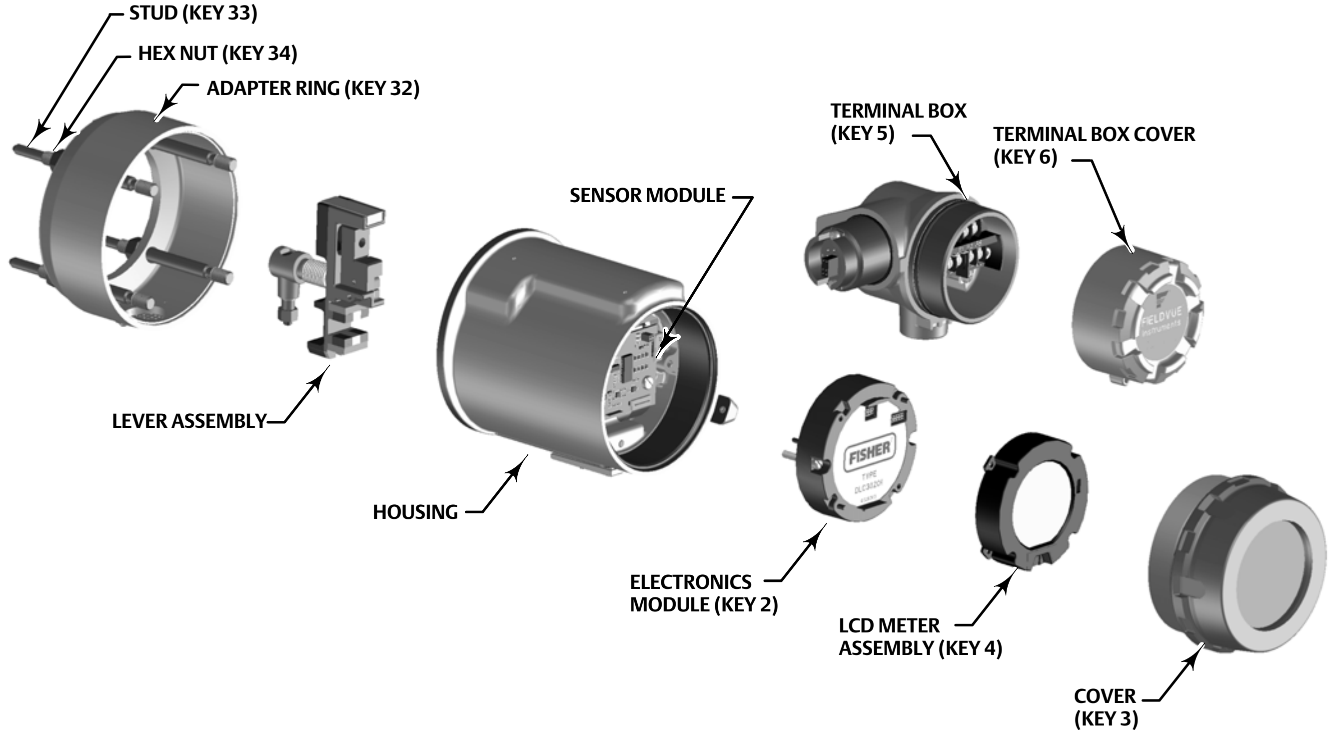
LCD Meter Assembly

⚠ WARNING

In an explosion-proof or flame-proof installation remove the electrical power before removing the instrument covers in a hazardous area. Personal injury or property damage may result from fire and explosion if power is applied to the instrument with the covers removed.

The digital level controller is designed with a dual-compartment housing; one compartment contains the LCD meter and Electronics Module; the other contains all wiring terminals and the communication receptacles. The LCD meter is located in the compartment opposite the wiring terminals, as shown in figure 7-1.

Figure 7-1. FIELDVUE DLC3020f Digital Level Controller Assembly



Removing the LCD Meter

Perform the following procedure to remove the LCD meter.

1. Disconnect power to the digital level controller.
2. Remove the cover from the transducer housing. In explosive atmospheres, do not remove the instrument cover when the circuit is alive, unless in an intrinsically safe installation
3. Loosen the two screws that anchor the LCD meter to the Electronics Module. These screws are captive and should not be removed.
4. Firmly grasp the LCD meter and pull it straight away from the Electronics Module. Retain the six-pin dual header for later reinstallation.

Replacing the LCD Meter

Perform the following procedure to replace the LCD meter.

1. Verify that the interconnection header is in the six-pin socket on the face of the Electronics Module. The longer set of pins should be inserted in the Electronics Module socket.
2. Decide which direction to orient the meter. The meter can be rotated in 90-degree increments for easy viewing. Position one of the four six-pin sockets on the back of the meter to accept the interconnection header, and insert the long meter screws into the two holes on the meter to coincide with the appropriate holes on the Electronics Module.

3. Attach the meter to the interconnection pins. Thread the long meter screws into the holes on the Electronics Module and tighten to secure the meter.
4. Note the position of the alarm jumper on the LCD meter removed from the digital level controller. Remove the alarm jumper and install it on the replacement meter in the same position.
5. Install the six-pin dual header on the LCD meter. Carefully insert the LCD meter to mate with the interconnecting pins with the receptacles on the Electronics Module .

CAUTION

To prevent damage to the interconnecting pins when installing the LCD Meter, use the guide pins to insert the LCD meter straight onto the Electronics Module, without twisting or turning.

6. Replace the cover. Tighten 1/3 of a revolution after the cover begins to compress the O-ring. Both instrument covers must be fully engaged to meet explosion-proof or flameproof requirements.

Electronics Module

Removing the Electronics Module

Perform the following procedure to remove the Electronics Module.

Note

The electronics are sealed in a moisture-proof plastic enclosure referred to as the Electronics Module. The assembly is a non-repairable unit; if a malfunction occurs the entire unit must be replaced.

⚠ WARNING

On an explosion-proof instrument, remove the electrical power before removing the instrument covers in a hazardous area. Personal injury or property damage may result from fire and explosion if power is applied to the instrument with the covers removed.

1. Disconnect power to the digital level controller.
2. Remove the cover from the transducer housing. In explosive atmospheres, do not remove the instrument cover when the circuit is alive, unless in an intrinsically safe installation. Remove the LCD meter assembly.
3. Loosen the two screws that anchor the Electronics Module to the transducer housing. These screws are captive and should not be removed.
4. Firmly grasp the Electronics Module and pull it straight out of the housing.

Replacing the Electronics Module

Perform the following procedure to replace the Electronics Module.

1. Carefully insert the Electronics Module to mate the interconnecting pins with the receptacles on the Transducer housing.

CAUTION

To prevent damage to the interconnecting pins when installing the Electronics Module, use the guide pins to insert the Electronics Module straight onto the Transducer housing receptacles without twisting or turning.

2. Tighten the two mounting screws. Replace the LCD meter assembly.
3. Replace the cover. Tighten 1/3 of a revolution after the cover begins to compress the O-ring. Both instrument covers must be fully engaged to meet explosion-proof requirements.

Terminal Box

The terminal box is located on the transducer housing and contains the terminal strip assembly for field wiring connections. Unless indicated otherwise, refer to figure 8-1.

⚠ WARNING

On an explosion-proof instrument, remove the electrical power before removing the instrument covers in a hazardous area. Personal injury or property damage may result from fire and explosion if power is applied to the instrument with the covers removed.

Removing the Terminal Box

1. Loosen the set screw (key 31) in the terminal box cover assembly (key 6) so that the cover can be unscrewed from the terminal box.
2. After removing the cover (key 6), note the location of field wiring connections and disconnect the field wiring from the wiring terminals.
3. Remove the screw (key 7), and pull out the terminal box assembly.

CAUTION

To avoid damaging the terminal box assembly connector, pull the terminal box assembly straight out of the housing, without twisting or turning.

Replacing the Terminal Box

Note

Inspect all O-rings for wear and replace as necessary.

1. Apply sealant to the O-ring (key 27) and install the O-ring over the stem of the terminal box as shown in figure 8-3.
2. Orient the terminal box so that the connectors engage properly, and carefully insert the terminal box into the transducer housing until the O-ring is seated.

CAUTION

To avoid damaging the mating pins in the transducer housing, ensure that the guiding mechanism is engaged properly before applying force.

3. Fasten the terminal box to the transducer housing with the screw (key 7). Tighten the screw to 6 N•m (53 lbf•in).
4. Apply sealant to the O-ring (key 26) and install the O-ring over the cover threads on the terminal box. Use a tool to prevent cutting the O-ring while installing it over the threads.
5. Reconnect the field wiring as noted in step 2 in the Removing the Terminal Box procedure.
6. Apply lubricant to the threads on the terminal box to prevent seizing or galling while installing the terminal box cover.
7. Screw the terminal box cover assembly (key 6) completely onto the terminal box to seat the O-ring (key 26). Loosen the cover (not more than 1 turn) until the set screw (key 31) aligns with one of the recesses in the terminal box beneath the cover. Tighten the set screw to engage the recesses but no more than 0.88 N•m (7.8 lbf•in).
8. Apply lubricant to the conduit entrance plug (key 28) and install it in the unused conduit entrance.

Removing and Replacing the Inner Guide and Access Handle Assembly

The access handle and inner guide are located on the transducer housing. Unless indicated otherwise, refer to figure 8-2.

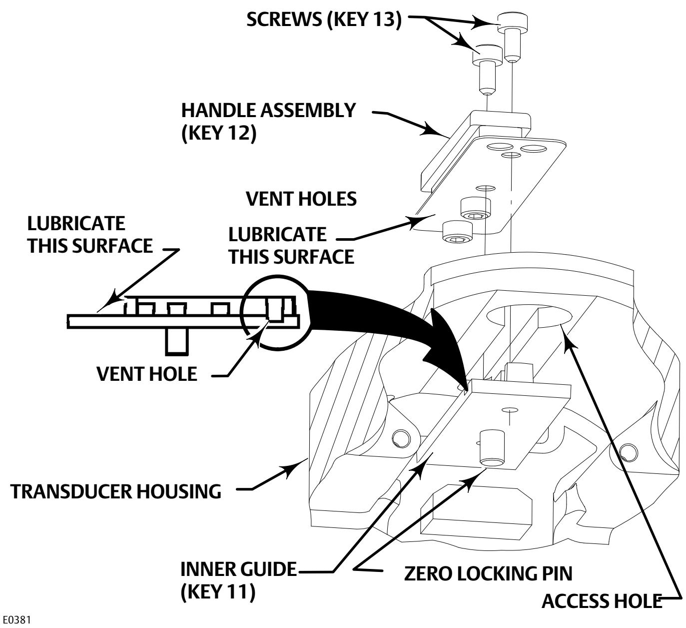
1. Remove the digital level controller from the sensor as described in Removing the Digital Level Controller from the Sensor.
2. Loosen and remove the hex nuts (key 34) from the studs (key 33) and remove the adapter ring (key 32) (see figure 8-1).

Note

In the next step the screws (key 13) will be attracted by the magnets on the lever assembly. Use care to keep the screws from falling beneath the coupling shield.

3. Remove the coupling shield (key 16) by removing the two screws (key 13). Take care not to drop the screws into the lever assembly compartment where they will be attracted by the magnets.
4. Loosen and remove the two screws (key 13) in the handle assembly (key 12). Remove the handle assembly and the inner guide (key 11).
5. Apply thread lock to the internal threads of the replacement inner guide. Also apply a thin coat of a light grade of grease to the zero locking pin on the inner guide and on the surface that is opposite the zero locking pin, as shown in figure 7-2 (this surface contacts the transducer housing when installed).

Figure 7-2. Installing Inner Guide and Access Handle Assembly



6. Place the inner guide in the slot inside the transducer housing so that the vent holes in the inner guide (the milled slots in the inner guide, see figure 7-2) face the exterior of the housing and are over the access hole.
7. Apply a thin coat of a light grade of grease to the surface of the replacement handle assembly (see figure 7-2) where it will contact the transducer housing.
8. Install the handle assembly (key 12) in the slot of the transducer housing over the inner guide (key 11) so that the vent holes in the handle assembly are over the access hole.
9. Install two screws (key 13) to secure the handle assembly (key 12) to the inner guide (key 11). Tighten the screws to 0.48 N•m (4.2 lbf•in).
10. Press down on the handle as shown in figure 2-2 and slide it forward to make sure it works smoothly and that the zero locking pin engages the lever assembly. Also check for free travel of the lever assembly when the handle is in the unlocked position.
11. Install the coupling shield (key 16) and secure with the two screws (key 13). Tighten the screws to 0.48 N•m (4.2 lbf•in).
12. Refer to figure 8-1. Install the adapter ring (key 32) on the studs (key 33) and secure with hex nuts (key 34).
13. When re-installing the digital level controller, follow the appropriate procedure outlined in the Installation section. Also setup the digital level controller as described in the Setup and Calibration section.

Lever Assembly

Removing the Lever Assembly

The lever assembly is located in the transducer housing. Unless indicated otherwise, refer to figure 8-2.

1. Remove the digital level controller from the sensor as described in Removing the Digital Level Controller from the Sensor.
2. Loosen and remove the hex nuts (key 34) from the studs (key 33) and remove the adapter ring (key 32) (see figure 8-1).

3. Remove the coupling shield (key 16) by removing the two screws (key 13). Take care not to drop the screws into the lever assembly compartment where they will be attracted by the magnets.
4. Inspect the lever assembly alignment with the housing. If it is off center or not co-axial with the main housing, continue with the removal procedure.
5. Loosen and remove the mounting screw (key 14) from the lever assembly.
6. Loosen the flexure block from its machined pocket in the housing, by inserting a smooth tool into the hole for the mounting screw, and gently rocking it back and forth in what would be the vertical axis if the transmitter were installed.
7. Lift the lever assembly out of the housing.

Inspect the flexure for damage. If the flexure is bent or torn, replace the lever assembly.

Replacing the Lever Assembly

Replacing the lever assembly in the field may result in a slight degradation in linearity performance, since the factory characterizes the entire transducer module as a unit. For most applications, this degradation should not be noticeable. (If guaranteed restoration to factory specification is desired, the entire transducer module should be replaced.)

1. Move the zero-pin slide to the locking position.
2. Apply a thin coat of a light grade of grease to the internal thread of the hole for the lever mounting bolt.
3. Hold lever assembly by coupling block and guide the flexure block into its aligning slot in the housing without applying any downward force to the sprung parts of the lever assembly.

CAUTION

To prevent damage to the flexure when inserting the flexure block into its aligning slot in the housing, apply pressure to the flexure block only.

A long pin inserted into the bolt-hole in the flexure block may be used to pull it against the inside corner of the aligning slot.

4. Secure the block by reinstalling the M5x20 socket-head cap screw (key 14). Torque to 2.8 N•m (25 lbf•in) $\pm$ 10%.
5. Mark bolt head and block with a movement-detecting sealant.
6. Install the coupling shield (key 16) and secure with the two screws (key 13). Tighten the screws to 0.48 N•m (4.2 lbf•in).
7. Refer to figure 8-1. Install the adapter ring (key 32) on the studs (key 33) and secure with hex nuts (key 34). When re-installing the digital level controller, follow the appropriate procedure outlined in the Installation section. Set up and calibrate the digital level controller as described in the Configuration and Calibration sections.

Packing for Shipment

If it becomes necessary to return the unit for repair or diagnosis, contact your Emerson Process Management sales office for returned goods information.

CAUTION

Lock the lever assembly when shipping the stand-alone instrument, to prevent damage to the flexure.

Use the original shipping carton if possible.

Instrument Troubleshooting

If communication or output difficulties are experienced with the instrument, refer to the troubleshooting information provided in 7-2.

Table 7-2. Troubleshooting

Symptom	Possible Cause	Corrective Action
1. Output Drifting while at fixed process input.	1.a Sensor	1.a1 Check torque tube spring rate change versus process temperature. Use appropriate material for process temperature.
	1.b Configuration Data	Connect the Field Communicator and: 1.b1 Check stored *Specific Gravity* values against independent measurement of process density. If process SG has changed from calibration values, correct configuration data to match process
2. Instrument will not communicate.	2.a No power to device	2.a1 Ensure device is connected to the segment (see host system documentation).
		2.a2 Measure the terminal voltage. Terminal voltage should be between 9 and 32 VDC.
		2.a3 Check to be sure device is drawing current. There should be approximately 19 mA.
	2.c Incompatible network settings	2.c Change host parameters. Refer to host documentation for procedure.
	2.d Defective terminal box.	2.d Check continuity from each screw terminal to the corresponding PWB connector pin. If necessary, replace the terminal box assembly (see Replacing the Terminal Box on page 56).
	2.e Defective Field Communicator or modem cable.	2.e If necessary, repair or replace cable.
	2.f Fieldbus card defective or not compatible with PC.	2.f Replace Fieldbus card.
3. Device does not stay on segment.	3.a Incorrect signal level.	3.a1 Wrong cable type or segment length too long. See Site Planning Guide.
		3.a1 Bad power supply or conditioner.
	3.b Excess noise on segment.	3.b1 Check integrity of wiring connections. Make sure cable shield is grounded only at the control system.
		3.b2 Check for corrosion or moisture on terminals in terminal box (refer to page 55 for terminal box information).
		3.b3 Check for bad power supply.
4. A value cannot be written to a parameter.	4.a Resource block parameter Write Lock may be set to Locked.	4.a Change Write Lock to Not Locked (refer to page 35).
	4.b If a transducer block parameter, the mode may be incorrect or other parameter settings might be preventing a write.	4.b1 Check table B-54. If necessary change the transducer block target mode to Manual.
		4.b2 Check table B-54. If necessary adjust parameter settings.
	4.c You have attempted to write a value that is outside the valid range.	4.c Check the range values listed for the parameter (refer to the appropriate parameter definition table in Appendix B).
	3.d Function block or in/out block mode may be incorrect.	3.d. Confirm that block is in correct mode for writing to any given parameter.

-Continued-

Table 7-2. Troubleshooting

Symptom	Possible Cause	Corrective Action
5. Function block actual mode does not change with target mode.	5.a Resource block actual mode is Out of Service.	5.a Change Resource block target mode to Auto (see page 150, Resource Block Mode, or host system documentation).
	5.b Transducer block actual mode is not Auto.	5.b Change transducer block target mode to Auto (see page 157, Transducer Block Mode or host system documentation).
	5.c Schedules that define when function blocks execute are not set correctly.	5.c Set the schedules using host system or configuration tool. All function blocks must be in a schedule that is downloaded to the device.
	5.d Configuration error	5.d Look for configuration error bit in BLOCK_ERR. By default, all enumerature type parameters are initialized to 0 (undefined). They must be configured before the block can be put into service.
6. Input or Output Block does not go to mode target	6.a Resource block actual mode is Out of Service	6.a Change Resource block target mode to Auto (see page 150, Resource Block Mode, or host system documentation).
	6.b Transducer block actual mode is not Auto.	6.b Change transducer block target mode to Auto (see page 157, Transducer Block Mode or host system documentation).
	6.c Transducer has detected a hardware failure.	6.c See transducer section of Detailed Setup for repair information.
	6.d Schedules that define when function blocks execute are not set correctly.	6.d Set the schedules using host system or configuration tool. All function blocks must be in a schedule that is downloaded to the device.
	6.e Configuration error.	6.e Look for configuration error bit in BLOCK_ERR. By default, all enumerature type parameters are initialized to 0 (undefined). They must be configured before the block can be put into service.
7. Block dynamic parameters do not update	7.a Block actual mode is Out of Service	7.a Change the block target mode to an operational mode (see FOUNDATION fieldbus Communication, Appendix C and host system documentation).
8. OUT is not being automatically updated from the AI block.	8.a Transducer block mode in not Auto.	8.a Change transducer block mode to Auto.
	8.b AI block is not scheduled	8.b Schedule the AI block.
9. Transducer block setpoint Setpoint(D) (SETPOINT_D [32]) is not being automatically updated from the DO block.	9.a Transducer block mode is not Auto.	9.a Change transducer block mode to Auto.
	9.b DO block is not active.	8.b Change Outblock Selection to DO Control.
10. Instrument will not calibrate.	10.a Configuration errors.	10.a Verify configuration.
	10.b Lever Assembly is locked	10.b Check the Lever Assembly lock and unlock.
	10.c Lever Assembly is not clamped to the torque tube.	10.c Clamp the Lever Assembly to the torque tube.
	10.d Device setup doesn't match real device conditions.	10.d Adjust settings to match device conditions and setup.
11. Field Communicator does not turn on.	11.a Battery pack not charged.	11.a Charge battery pack. Note: Battery pack can be charged while attached to the Field communicator or separately. The 475 Field Communicator is fully operable while the battery pack is charging. Do not attempt to charge the battery pack in a hazardous area.

Section 8 Parts

Parts Ordering

Whenever corresponding with your Emerson Process Management sales office about this equipment, always mention the controller serial number. When ordering replacement parts, refer to the 11-character part number of each required part as found in the following parts list. Parts that do not show part numbers are not orderable.

WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Process Management, should not, under any circumstances, be used in any Fisher instrument. Use of components not supplied by Emerson Process Management may void your warranty, might adversely affect the performance of the instrument, and could cause personal injury and property damage.

Mounting Kits

Contact your Emerson Process Management sales office for information on ordering the following DLC3020f mounting options:

- Fisher 249 Sensors - heat insulator for field mounting the DLC3020f
- Masoneilan 12100, 12800 Series
- Masoneilan 12100, 12800 Series with heat insulator
- Masoneilan 12200, 12300 Series
- Masoneilan 12200, 12300 Series with heat insulator
- Yamatake NQP
- Yamatake NQP with heat insulator
- Foxboro Eckardt 134LD and 144LD
- Foxboro Eckardt 134LD and 144LD with heat insulator
- Foxboro Eckardt LP167
- Foxboro Eckardt LP167 with heat insulator

Note

Contact your Emerson Process Management sales office for information on the availability of additional mounting kits.

Parts Kits

	Description	Part Number
1*	Small Hardware Spare Parts Kit	19B1643X052
	Includes	Qty/kit
	Screw (key 7)	1
	Screw, hex socket (key 13)	6
	Screw, cap, hex socket (key 14)	1
	Set Screw (key 20)	2
	Set Screw (key 31)	2
	Test Terminal (key 24)	4
	Wire Retainer (key 25)	8
	Nut (key 34)	4
	Alarm Jumper (key 35) (not used for DLC3020f)	2
	Header Assembly (key 38)	2
2*	Spare O-Rings Kit Includes three each of keys 21, 26, and 27	19B1643X022
3*	Coupling Hardware Spare Parts Kit	19B1643X042
	Includes	Qty/kit
	Clamp Nut (key 76)	1
	Washer, Lock, Spring (key 77)	1
	Bolt, lock, coupling block(key 82)	1

Parts List

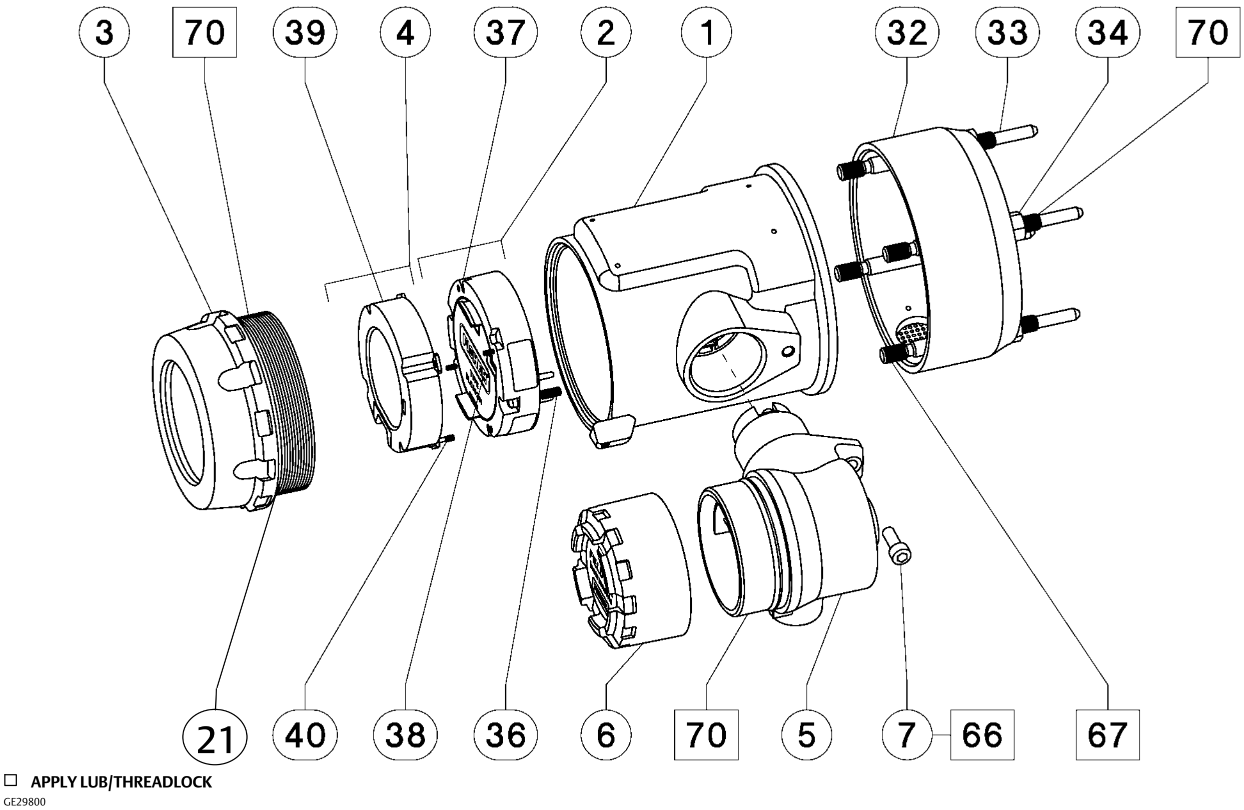
Note
Part numbers are shown for recommended spares only. For part numbers not shown, contact your Emerson Process Management sales office.

DLC3020f Digital Level Controller (figure 8-1)

Key	Description	Part Number
1	Transducer Assembly(1)	
2	Electronics Assembly, includes captive screws (key 36), header assembly (key 38) and encapsulated board	
3	Cover Assembly, includes O-ring (key 21)	
4	LCD Meter Assembly, includes header assembly (key 38) and captive screws (key 40), and LCD Meter assembly	
5*	Terminal Box Assembly	GE29688X022
6	Terminal Box Cover Assembly, includes labels and set screw	
7	Screw, hex socket(2)	
8	Nameplate	
9	Drive Screw, 18-8 SST	
21*	O-ring, nitrile(3)	1K1810X0012
32	Adaptor Ring, A03600	
33	Stud, S30300 (4 req'd)	
34	Hex Nut, S30400 (4 req'd)	
36	Screw, captive, 18-8 SST For electronics ass'y (2 req'd)(4)	
37	Encapsulated Board	
38	Header Assembly, Dual Row(2)	
39	LCD Meter	
40	Screw, captive, 18-8 SST For LCD meter (2 req'd)(5)	18B5732X012
66	Anti-Seize Sealant (not furnished with instrument)	
67	Thread locking adhesive (medium strength) (not furnished with instrument)	
70	Lithium grease (not furnished with instrument)	

* Recommended spare part
1. These parts are not replaced in the field due to serialization and characterization issues, but can be replaced at a qualified service center. Contact your Emerson Process Management sales office for additional information.
2. Included in small hardware spare parts kit.
3. Included in spare O-rings kit.
4. Included in the Electronics Ass'y, key 2
5. Included in the LCD Meter Ass'y. key 4

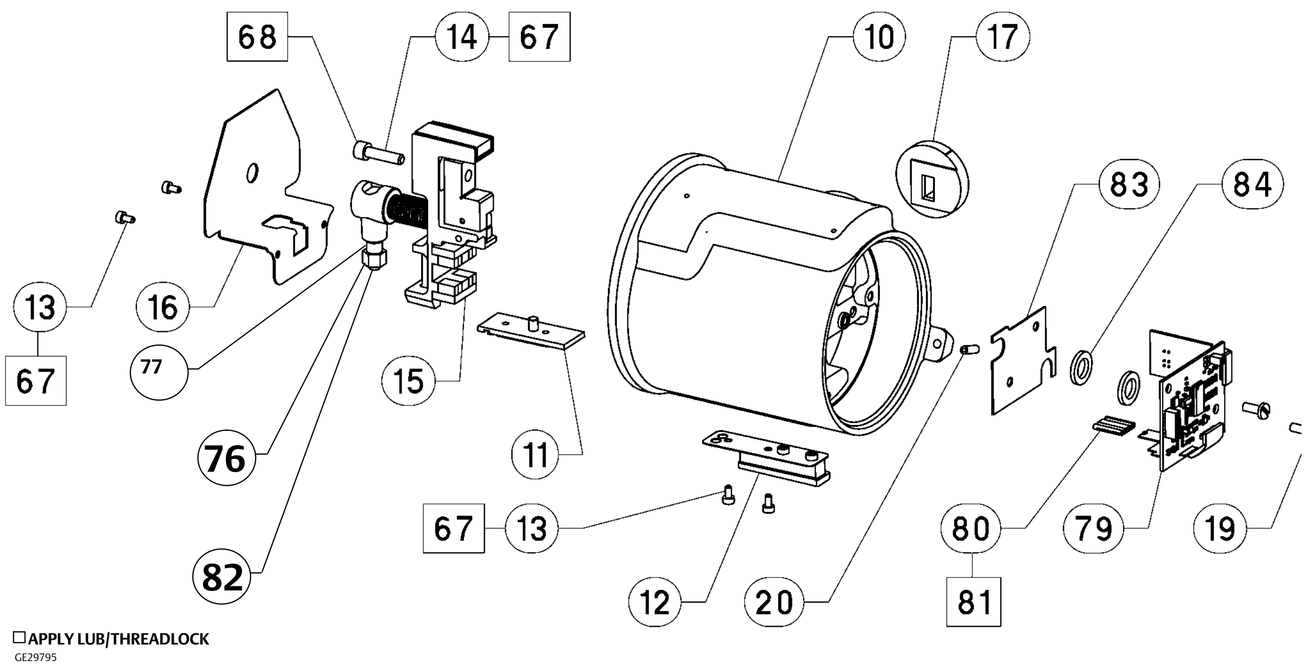
Figure 8-1. DLC3020f Digital Level Controller Assembly



Transducer Assembly (figure 8-2)

Key	Description
10	Transducer Housing
11	Inner Guide, aluminum
12	Handle Assembly, aluminum/SST
13	Screw, hex socket, 18-8 SST (4 req'd)
14	Screw, cap, 18-8 SST
15	Lever Assembly, aluminum/SST/NdFeB
16	Coupling Shield, 18-8 SST
17	Align/Clamp Ring
19	Machine Screw, pan head (2 req'd)
20	Set Screw, 18-8 SST(2)
67	Thread Locking adhesive (medium strength) (not furnished with instrument)
68	Sealant
76	Clamp Nut, 18-8 SST(2)(6)
77	Spring Lock Washer, 18-8 SST(2)(6)
79	Sensor Board Assembly(1)
80	Hall Sensor Guard, plastic
81	Compound, silicone
82	Bolt, lock, coupling block, SST(6)
83	Shield
84	Spacer

Figure 8-2. DLC3020f Digital Level Controller Transducer Assembly

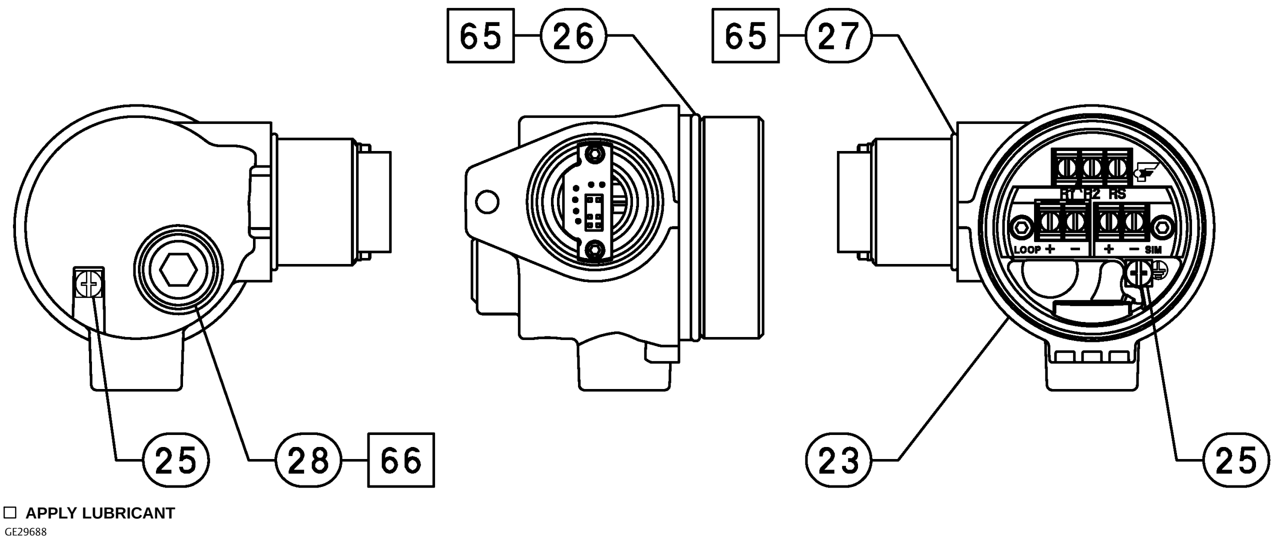


*Recommended spare parts
1. These parts are not replaced in the field due to serialization and characterization issues, but can be replaced at a qualified service center. Contact your Emerson Process Management sales office for additional information.
2. Included in small hardware spare parts kit.
6. Included in Coupling Hardware Spare Parts Kit

Terminal Box Assembly (figure 8-3)

Key	Description	Part Number
23	Terminal Box Subassembly	
25	Wire Retainer, 18-8 SST (8 req'd)(2)	
26*	O-Ring, nitrile(3)	1H8762X0012
27*	O-Ring, nitrile(3)	10A8218X032
28	Pipe Plug, 18-8 SST	
65	Sealant, Silicone (not furnished with instrument)	
66	Anti-Seize Compound (not furnished with instrument)	

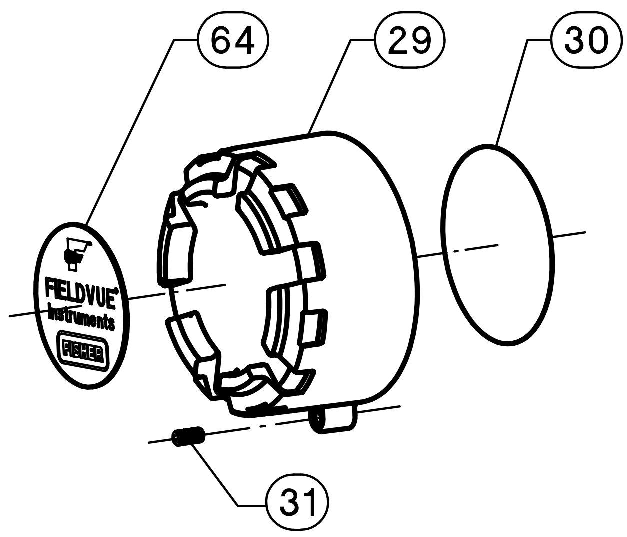
Figure 8-3. Terminal Box Assembly



Terminal Box Cover Assembly (figure 8-4)

Key	Description
29	Terminal Box Cover
30	Label, internal, plastic
31	Set Screw, hex socket, 18-8 SST(2)
64	Label, external

Figure 8-4. Terminal Box Cover Assembly



*Recommended spare parts
2. Included in small hardware spare parts kit.
3. Included in spare O-rings kit.

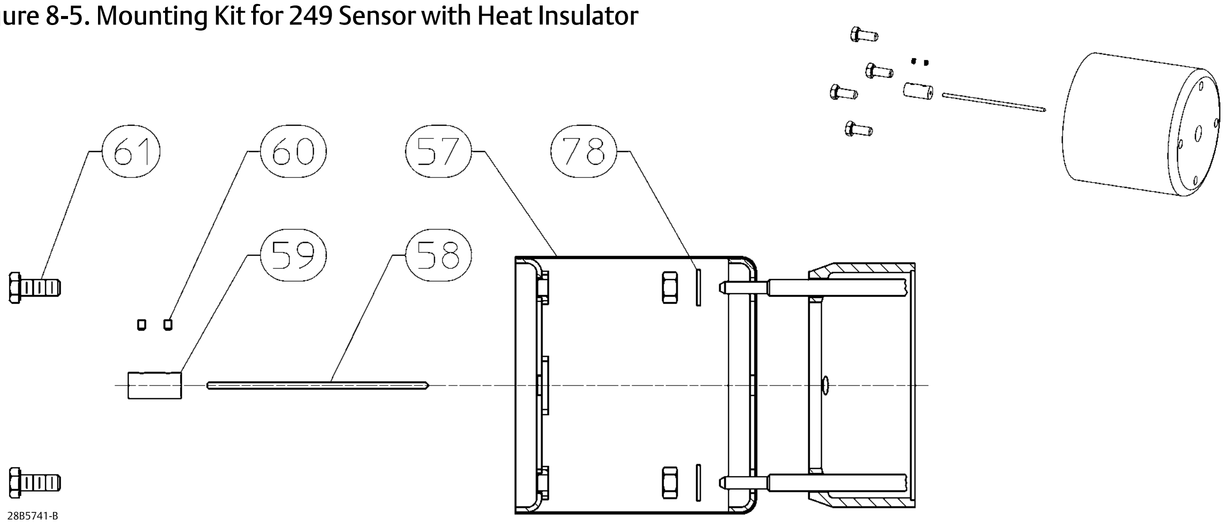
Mounting Parts

These parts are available as a kit as indicated in the Mounting Kits section. Contact your Emerson Process Management sales office for ordering information.

249 Sensor with Heat Insulator (figure 8-5)

Key	Description
57	Heat Insulator, S30400
58	Shaft Extension, N05500
59	Shaft Coupling, S30300
60	Set Screw, hex socket, SST (2 req'd)
61	Screw, hex hd, SST (4 req'd)
78	Washer, plain (4 req'd)

Figure 8-5. Mounting Kit for 249 Sensor with Heat Insulator



Masoneilan Sensors (figures 8-6 and 8-7)

Key Description

12100 or 12800 without Heat Insulator

Key	Description
58	Shaft Extension, S31600
59	Shaft Coupling, S30300
60	Set Screw, hex socket, SST (2 req'd)
61	Screw, hex hd, 18-8 SST (4 req'd)
62	Mounting Adapter, A03560
63	Screw, hex socket, (4 req'd)

12100 or 12800 with Heat Insulator

Key	Description
57	Heat Insulator, S30400
58	Shaft Extension, S31600
59	Shaft Coupling, S30300
60	Set Screw, hex socket, SST (2 req'd)
61	Screw, hex hd, SST (4 req'd)
62	Mounting Adapter, A03560
63	Screw, hex socket, steel (4 req'd)
78	Washer, plain (4 req'd)

Key Description

12200 or 12300 without Heat Insulator

Key	Description
58	Shaft Extension N05500
59	Shaft Coupling, S30300
60	Hex Socket Screw (2 req'd)
62	Mounting Adaptor, A92024
74	Hex Nut, SST (4 req'd)
75	Hex Cap Screw, SST (4 req'd)

12200 or 12300 with Heat Insulator

Key	Description
57	Heat Insulator, S30400
58	Shaft Extension S31600
59	Shaft Coupling, S30300
61	Hex Cap Screw, SST (4 req'd)
60	Hex Socket Screw (2 req'd)
62	Mounting Adaptor, A92024
74	Hex Nut, SST (4 req'd)
75	Hex Cap Screw, SST (4 req'd)
78	Washer, plain (4 req'd) not shown

Figure 8-6. Mounting Kit for Masoneilan 12200 and 12300 Sensor without Heat Insulator

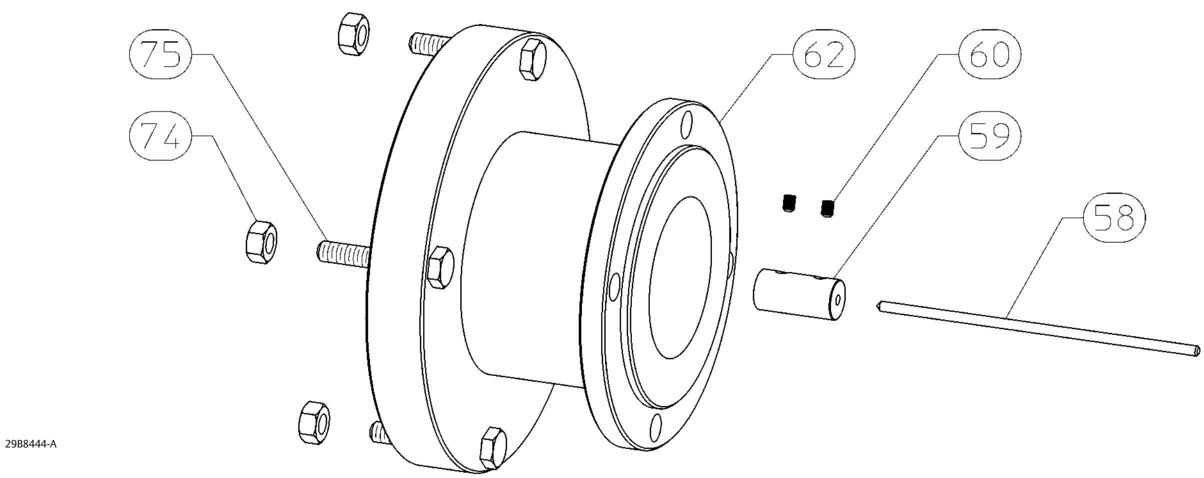
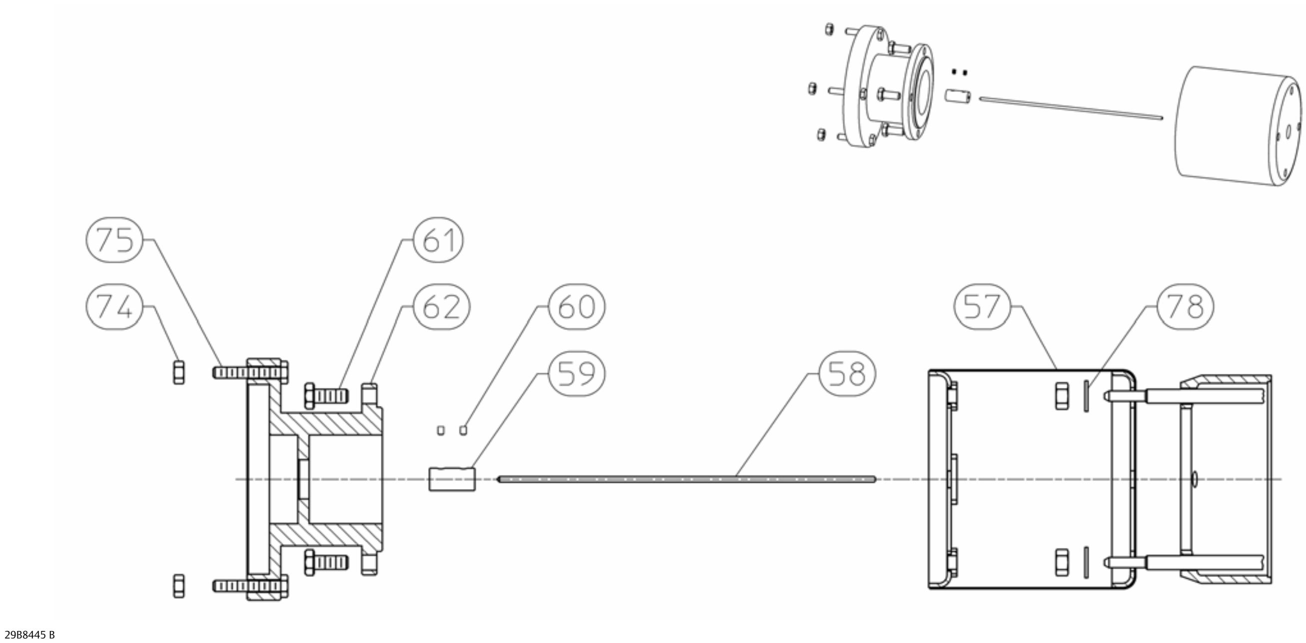


Figure 8-7. Mounting Kit for Masoneilan 12200 and 12300 Sensor with Heat Insulator



Yamatake NQP Sensor

Key Description

Without Heat Insulator

58 Shaft Extension, S31600
59 Shaft Retainer, S30400
60 Hex Socket Screw, SST
62 Mounting Adaptor, A96061
63 Hex Socket Screw, SST (3 req'd)
71 Hex Socket Screw, SST (3 req'd)
72 Shaft Adapter, S30400
73 Hex Socket Screw, SST (2 req'd)

With Heat Insulator

57 Heat Insulator, S30400
58 Shaft Extension, S31600
59 Shaft Retainer, S30300
60 Hex Socket Screw, SST
61 Hex Cap Screw, SST (4 req'd)
62 Mounting Adaptor, A96061
63 Hex Socket Screw, SST (3 req'd)
71 Hex Socket Screw, SST (3 req'd)
72 Shaft Adapter, S30400
73 Hex Socket Screw, SST (2 req'd)
78 Washer, plain (4 req'd)

Foxboro-Eckardt Sensors

Key Description

144LD without Heat Insulator

58 Shaft Extension, S31600
59 Shaft Coupling, S30300
60 Set Screw, hex socket, SST (2 req'd)
62 Mounting Adapter, A92024
74 Hex Nut, steel (4 req'd)
75 Hex Cap Screw, steel (4 req'd)

144LD with Heat Insulator

57 Heat Insulator, S30400
58 Shaft Extension, 316 SST
59 Shaft Coupling, S30300
60 Set Screw, hex socket, SST (2 req'd)
61 Screw, hex hd, SST (4 req'd)
62 Mounting Adapter, A92024
74 Hex Nut, steel (4 req'd)
75 Hex Cap Screw, steel (4 req'd)
78 Washer, plain (4 req'd)

LP167 without Heat Insulator

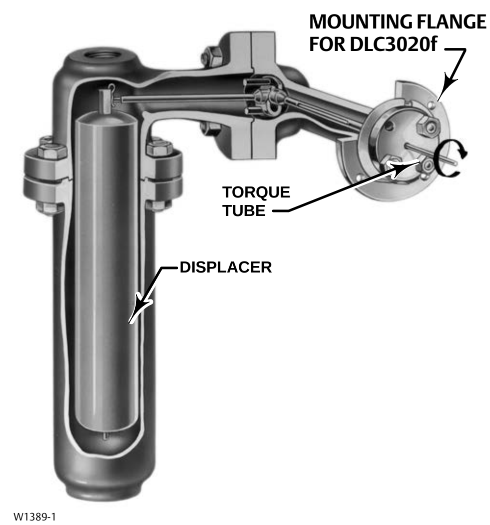
58 Shaft Extension, S31600
59 Shaft Coupling, S30300
60 Set Screw, hex socket, SST (2 req'd)
62 Mounting Adapter, A92024
63 Screw, hex socket, (4 req'd)

Appendix A Principle of Operation

Digital Level Controller Operation

The DLC3020f digital level controller is a fieldbus-powered instrument that measures liquid level or interface between two liquids. As the liquid level surrounding the **displacer** rises (figure A-1), the **torque tube** rotates clockwise; the reverse action occurs when the liquid level is lowered. The rotary motion of the **torque tube** is transferred to the **lever assembly** (figure A-2) which rotates an attached **magnet array**. The **sensor module** converts the changing magnetic field to a digital signal, which is ambient temperature compensated, linearized, and sent to the **electronics assembly**.

Figure A-1. Typical Sensor Operation



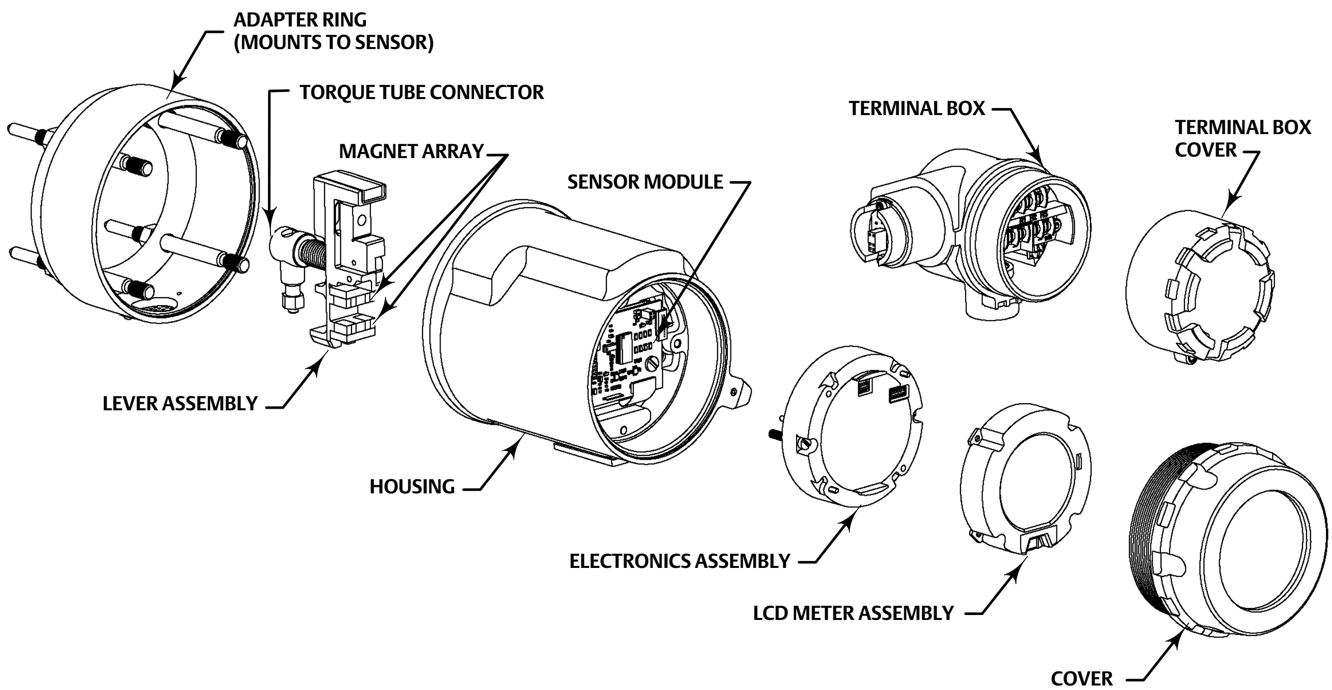
249 SENSOR (SIDE VIEW)

The **electronics assembly** actively compensates for changes in liquid density due to process temperature variances based on a process temperature input from a transmitter or a direct-wired RTD. The **electronics assembly** also computes the process variable (PV) and manages FOUNDATION fieldbus network communication.

The **terminal box** contains fieldbus, simulation, and RTD terminal connections. Circuits in the **terminal box** also provide reverse polarity, transient power surge, and electromagnetic interference (EMI) protection.

The **LCD meter** displays the process variable (PV) and various instrument alerts, as configured.

Figure A-2. DLC3020f Digital Level Controller Assembly

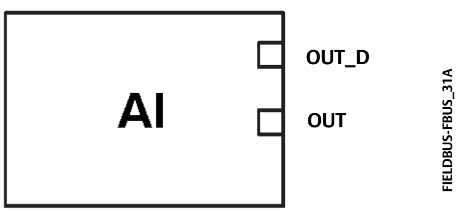


Appendix B Blocks

Analog Input (AI) Function Block

The Analog Input (AI) function block (figure B-1) processes field device measurements and makes them available to other function blocks. The output value from the AI block is in engineering units and contains a status indicating the quality of the measurement. The measuring device reports level status.

Figure B-1. Analog Input (AI) Function Block



OUT = THE BLOCK OUTPUT VALUE AND STATUS
OUT_D = DISCRETE OUTPUT THAT SIGNALS A SELECTED ALARM CONDITION

The AI block supports alarming, signal scaling, signal filtering, signal status calculation, mode control, and simulation. In Automatic mode, the block's output parameter (OUT [8]) reflects the process variable (PV [7]) value and status. In Manual mode, OUT [8] may be set manually. The Manual mode is reflected on the output status. A discrete output (OUT_D [37]) is provided to indicate whether a selected alarm condition is active. Alarm detection is based on the OUT [8] value and user specified alarm limits. Figure B-2 illustrates the internal components of the AI function block, and table B-5 lists the AI block parameters and their units of measure, descriptions, and index numbers.

Analog Input Block Modes

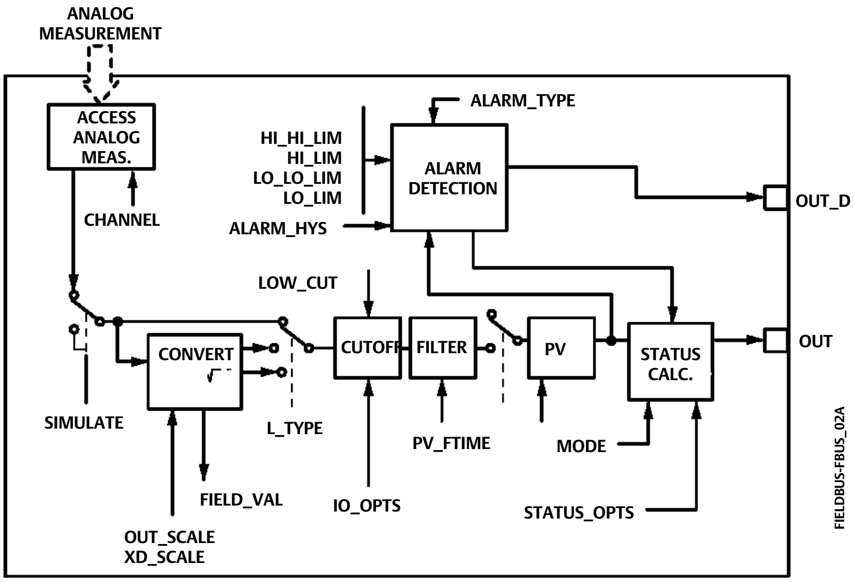
The AI function block supports three modes of operation as defined by the MODE_BLK [5] parameter:

- **Manual (Man)** The block output (OUT [8]) may be set manually.
- **Automatic (Auto)** OUT reflects the analog input measurement or the simulated value when simulation is enabled.
- **Out of Service (OOS)** The block is not processed. FIELD_VAL [19] and PV [7] are not updated and the OUT [8] status is set to Bad: Out of Service. The BLOCK_ERR [6] parameter shows Out of Service. In this mode, you can make changes to all configured parameters. The target mode of a block may be restricted to one or more of the supported modes.

Alarm Detection

A block alarm will be generated whenever the BLOCK_ERR [6] has an error bit set. Block errors for the AI block are defined in table B-3.

Figure B-2. Analog Input Function Block Schematic



NOTES:
OUT = BLOCK OUTPUT VALUE AND STATUS
OUT_D = DISCRETE OUTPUT THAT SIGNALS A SELECTED ALARM CONDITION.

Process Alarm detection is based on the OUT [8] value. You can configure the alarm limits of the following standard alarms:

- High (HI_LIM [28])
- High high (HI_HI_LIM [26])
- Low (LO_LIM [30])
- Low low (LO_LO_LIM [32])

In order to avoid alarm chattering when the variable is oscillating around the alarm limit, an alarm hysteresis in percent of the PV [7] span can be set using the ALARM_HYS [24] parameter. The priority of each alarm is set in the following parameters:

- HI_PRI [27]
- HI_HI_PRI [25]
- LO_PRI [29]
- LO_LO_PRI [31]

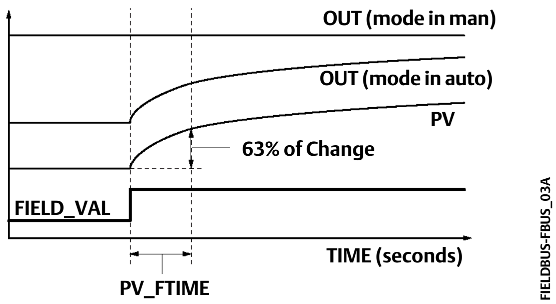
Alarms are grouped into five levels of priority, as shown in table B-1.

Table B-1. AI Function Block Alarm Priorities

Priority Number	Priority Description(1)
0	The priority of an alarm condition changes to 0 after the condition that caused the alarm is corrected.
1	An alarm condition with a priority of 1 is recognized by the system, but is not reported to the operator.
2	An alarm condition with a priority of 2 is reported to the operator, but generally does not require operator attention (such as diagnostics and system alerts).
3-7	Alarm conditions of priority 3 to 7 are advisory alarms of increasing priority.
8-15	Alarm conditions of priority 8 to 15 are critical alarms of increasing priority.

1. The priority classes “advise” and “critical” have no relationship to PlantWeb Alerts.

Figure B-3. Analog Input Function Block Timing Diagram



Status Handling

The AI block only gets Good Non-Specified Unlimited or Bad Device Failure for status from the transducer. This is reflected in FIELD_VAL.STATUS [19.1]. PV.STATUS [7.1] is the same as FIELD_VAL.STATUS [19.1]. OUT.STATUS [8.1] can also reflect Bad, Out of Service in addition to PV.STATUS [7.1] values.

In the STATUS_OPTS [14] parameter, you can select from the following options to control the status handling:

Propagate Fail Forward—If the status from the sensor is Bad, Device failure or Bad, Sensor failure, propagate it to OUT without generating an alarm. The use of these sub-status in OUT is determined by this option. Through this option, you may determine whether alarming (sending out an alert) will be done by the block or propagated downstream for alarming.

Uncertain if in Manual mode—The status of the Output is set to *Uncertain* when the mode is set to Manual.

Note

1. The instrument must be in Out of Service mode to set the status option.

2. The AI block only supports the Uncertain if in Manual and Propagate failure. Unsupported options are not grayed out; they appear on the screen in the same manner as supported options.

Channel Selection

See table B-2 for AI block channel selection information.

Table B-2. Channel Selection for the Analog Input Function Block

Channel	Parameter(1)	Block	Index Number	XD_SCALE Units
1	PRIMARY_VALUE	TB	14	Valid Length Units (DLC_UNITS.LENGTH UNITS [25.2])
1. Refer to table B-54 for transducer block parameter description.				

Filtering

The filtering feature changes the response time of the device to smooth variations in output readings caused by rapid changes in input. You can adjust the filter time constant (in seconds) using the PV_FTIME [18] parameter. Set the filter time constant to zero to disable the filter feature.

Signal Conversion

You can set the signal conversion type with the Linearization Type (L_TYPE [16]) parameter. You can view the converted signal (in percent of XD_SCALE [10]) through the FIELD_VAL [19] parameter.

$$\text{FIELD\_VAL} = \frac{100 \times (\text{Channel Value}) - \text{EU}^{*}@0\%}{(\text{EU}^{*}@100\% - \text{EU}^{*}@0\%)}$$

*XD_SCALE values

You can choose from direct, indirect, or indirect square root signal conversion with the L_TYPE [16] parameter.

Direct

Direct signal conversion allows the signal to pass through the accessed channel input value (or the simulated value when simulation is enabled).

PV = Channel Value

Indirect

Indirect signal conversion converts the signal linearly to the accessed channel input value (or the simulated value when simulation is enabled) from its specified range (XD_SCALE [10]) to the range and units of the PV [7] and OUT [8] parameters (OUT_SCALE [11]).

$$\text{PV} = \left(\frac{\text{FIELD\_VAL}}{100}\right) \times (\text{EU}^{**}@100\% - \text{EU}^{**}@0\%) + \text{EU}^{**}@0\%$$

**OUT_SCALE values

Indirect Square Root

Indirect Square Root signal conversion takes the square root of the value computed with the indirect signal conversion and scales it to the range and units of the PV [7] and OUT [8] parameters.

$$\text{PV} = \sqrt{\left(\frac{\text{FIELD\_VAL}}{100}\right)} \times (\text{EU}^{**}@100\% - \text{EU}^{**}@0\%) + \text{EU}^{**}@0\%$$

**OUT_SCALE values

When the converted input value is below the limit specified by the LOW_CUT [17] parameter, a value of zero is used for the converted value (PV [7]). This option is useful to eliminate false readings when the differential pressure measurement is close to zero.

Advanced Features

The AI function block provided with the DLC3020f provides added capability through the addition of the following parameters:

ALARM_SEL—Allows one or more of the process alarm conditions detected by the AI function block to be used in setting its OUT_D [37] parameter.

OUT_D—Discrete output of the AI function block based on the detection of process alarm condition(s). This parameter may be linked to other function blocks that require a discrete input based on the detected alarm condition.

STDDEV and CAP_STDDEV— are diagnostic parameters that can be used to determine the variability of the process.

Simulation

To support testing, you can either change the mode of the block to manual and adjust the output value, or you can enable simulation through the configuration tool and manually enter a value for the measurement value and its status. To enable simulation, you must first install the Simulate Enable jumper across the instrument AUX terminals (see page 19). Next you must use the configuration tool to enable the parameter SIMULATE [9].

With simulation enabled, the actual measurement value has no impact on the OUT [8] value or the status.

Block Errors

Table B-3 lists conditions reported in the BLOCK_ERR [6] parameter. Conditions in *italics* are inactive for the AI block and are given here only for your reference.

Table B-3. BLOCK_ERR Conditions

Condition Number	Condition Name and Description
0	*Other*
1	**Block Configuration Error** - the selected channel carries a measurement that is incompatible with the engineering units selected in XD_SCALE, the L_TYPE parameter is not configured, or CHANNEL = zero.
2	*Link Configuration Error*
3	**Simulate Active** - Simulation is enabled and the block is using a simulated value in its execution.
4	*Local Override*
5	*Device Fault State*
6	*Device Needs Maintenance Soon*
7	**Input failure/process variable had Bad status** - The hardware is bad, or a bad status is being simulated
8	*Output failure*
9	*Memory failure*
10	*Lost Static Data*
11	*Lost NV Data*
12	*Readback Check Failed*
13	*Device Needs Maintenance Now*
14	**Power Up** - This condition exists until the AI function block executes for the first time.
15	**Out of Service** - The actual mode is Out of Service.

Troubleshooting

Refer to table B-4 to troubleshoot any problem that you encounter.

Table B-4. Troubleshooting

Symptom	Possible Causes	Corrective Action
Mode will not leave OOS	Target mode is not set	Set target mode to something other than OOS
	Configuration error	BLOCK_ERR [6] will show the configuration error bit set. The following are parameters that must be set before the block is allowed out of OOS: ● CHANNEL [15] must be set to a valid value and cannot be left at initial value of 0. ● XD_SCALE [10]. UNITS_INDEX must match the units in the transducer block channel value. ● L_TYPE [16] must be set to Direct, Indirect, or Indirect Square Root and cannot be left at an initial value of 0.
	Resource block	The actual mode of the Resource block is OOS. See Resource Block Diagnostics for corrective action.
	Schedule	Block is not scheduled and therefore cannot execute to go to Target Mode. Schedule the block to execute.
Process and/or block alarms will not work	Features	FEATURES_SEL [18] in the resource block does not have Alerts enabled. Enable the Reports Supported bit.
	Notification	LIM_NOTIFY [32] in the resource block is not high enough. Set equal to MAX_NOTIFY [31], also in the resource block.
	Status Options	STATUS_OPTS [14] has Propagate Fault Forward bit set. This should be cleared to cause an alarm to occur.
Value of output does not make sense	Linearization Type	L_TYPE [16] must be set to Direct, Indirect, or Indirect Square Root and cannot be left at an initial value of 0.
	Scaling	Scaling parameters are set incorrectly: ● XD_SCALE.EU0 and EU100 should match that of the transducer block channel value. ● OUT_SCALE.EU0 and EU100 are not set properly.
Cannot set HI_LIMIT [28], HI_HI_LIMIT [26], LO_LIMIT [30], or LO_LO_LIMIT [32] VALUES	Scaling	Limit values are outside the OUT_SCALE.EU0 and OUT_SCALE.EU100 values. Change OUT_SCALE [11] or set values within range.

AI Block Parameter List

- Read/Write Capability: RO - Read Only, RW - Read Write
- Mode: The block mode(s) required to write to the parameter
- Double indentation and shaded Index Number indicates sub-parameter

Table B-5. Analog Input Block Parameter Definitions

Label PARAMETER_NAME	Index Number	RO / RW	Write Block Mode	Range	Initial Value	Description
Static Revision ST_REV	1	RO	NA	0 to 65535	0	Data Type: Unsigned16 The revision level of the static data associated with the function block. The revision value will be incremented each time a static parameter value in the block is changed
Tag Description TAG_DESC	2		ALL	7 bit ASCII	spaces	Data Type: Octet String The user description of the intended application of the block.
Strategy STRATEGY	3		ALL	0 to 65535	0	Data Type: Unsigned16 The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.
Alert Key ALERT_KEY	4		ALL	1 to 255	0	Data Type: Unsigned8 The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.
Block Mode MODE_BLK	5					Data Type: DS-69 Valid Bits: 7: OOS, 4: MAN, 3: AUTO The actual, target, permitted, and normal modes of the block. Target: The requested block mode Actual: The current mode of the block Permitted: Allowed modes for Target Normal: Most common mode for Target
TARGET	5.1	RW	ALL	OOS MAN AUTO	OOS until block is configured, then last valid target	
ACTUAL	5.2	RO	ALL		OOS	
PERMITTED	5.3	RW	ALL	OOS+MAN+AUTO	OOS, MAN, AUTO	
NORMAL	5.4	RW	ALL		AUTO	
Block Error BLOCK_ERR	6	RO		1: Block Configuration Error 3: Simulate Active 7: Input Failure/ Bad PV Status 14: Power-up 15: Out-of-Service		Data Type: Bit String 0=Inactive 1=Active Error status associated with the hardware or software for the AI block.
Process Value PV	7	RO		PV Status set equal to FIELDV_VAL Status		Data Type: DS-65 Reflects the scaled value from the configured channel. Units set by OUT_SCALE and L_TYPE.
Primary Output OUT	8		OOS, MAN	OUT_STATE		Data Type: DS-68 The block output value and status.

-Continued-

Table B-5. Analog Input Block Parameter Definitions (Continued)

Label PARAMETER_NAME	Index Number	RO / RW	Write Block Mode	Range	Initial Value	Description
Simulate SIMULATE	9					Data Type: DS-82 A group of data that contains the current transducer value and status, the simulated transducer value and status, and the enable/disable bit.
SIMULATE_STATUS	9.1		ALL		0	
SIMULATE_VALUE	9.2		ALL		0	
TRANSDUCER_STATUS	9.3	RO			0	
TRANSDUCER_VALUE	9.4	RO			0	
ENABLE/DISABLE	9.5		ALL	0=Not Initialized 1=Simulation Disabled 2=Simulation Active	1=simulate disabled	
Transducer Scale XD_SCALE	10		OOS	1010: Meter 1012: cm 1013: mm 1018: ft. 1019: in. 1342: percent	%	Data Type: DS-68 Transducer scaling (XD_SCALE) is applied to the value from the channel to produce the FIELD_VAL in percent. The XD_SCALE units code must match the channel units code (if one exists), or the block will remain in OOS mode after being configured.
Output Scale OUT_SCALE	11		OOS	1010: Meter 1012: cm 1013: mm 1018: ft. 1019: in. 1342: percent	%	Data Type: DS-68 The high and low scale values, engineering units code, and number of decimal places to be used in displaying the OUT parameter and parameters which have the same scaling as OUT.
Grant Deny GRANT_DENY	12					Data Type: DS-70 Options for controlling access of host computer and local control panels to operating, tuning, and alarm parameters of the block. GRANT: 0=NA, 1=granted DENY: 0=NA, 1=denied
GRANT	12.1		ALL	Valid Bits 0: Program 1: Tune 2: Alarm 3: Local	All bits: 0	
DENY	12.2		ALL		All bits: 0	
I/O Options IO_OPTS	13		OOS	10: Low cutoff	All bits: 0	Data Type: Bit String 0=Disable 1=Enable User options for Output Control.
Status Options STATUS_OPTS	14		OOS	3: Propagate Failure forward 6: Uncertain if Limited 7: Bad if Limited 8: Uncertain in Man Mode	All bits: 0	Data Type: Bit String 0=Disable 1=Enable User options for Status
AI Channel CHANNEL	15		OOS	Channel 1: PV	0	Data Type: Unsigned16 Used to select the type of threshold that is used to set the output.
Linearization Type L_TYPE	16		OOS, MAN	0: Undefined 1: Direct 2: Indirect 3: Ind. Sqr. Root	0: Undefined	Data Type: Enum Linearization type. Determines whether the field value is used directly (Direct), is converted linearly (Indirect), or is converted with the square root (Indirect Square Root). The OUT_SCALE is normally the same as the transducer, but if L_TYPE is set to Indirect or Ind Sqr Root, OUT_SCALE determines the conversion from FIELD_VAL to the output.
Low Cutoff LOW_CUT	17		ALL	Positive	0	Data Type: Float If calculated output is below this value the output is 0.
Process Value Filter Time PV_FTIME	18		ALL	Positive	0	Data Type: Float Time constant of first order filter on PV, in seconds.
Field Value FIELD_VAL	19	RO			0	Data Type: DS-65 Value of the field device analog input, with a status reflecting the Transducer condition.

-Continued-

Table B-5. Analog Input Block Parameter Definitions (Continued)

Label PARAMETER_NAME	Index Number	RO / RW	Write Block Mode	Range	Initial Value	Description
Updated Event UPDATE_EVT	20					Data Type: DS-73 This alarm is generated whenever a static parameter is changed.
UNACKNOWLEDGED	20.1	RW	NA	0=Undefined 1=Acknowledged 2=Unacknowledged	0=Undefined	
UPDATE_STATE	20.2	RO	NA	0=Undefined 1=Update reported 2=Update not reported	0=Undefined	
TIME_STAMP	20.3	RO	NA		0	
STATIC_REVISION	20.4	RO	NA		0	
RELATIVE_INDEX	20.5	RO	NA		0	
Block Alarm BLOCK_ALM	21					Data Type: DS-72 The block alarm is used for all configuration, hardware, connection failure or system problems in the block. The cause of the alert is entered in the subcode field.
UNACKNOWLEDGED	21.1	RW		0=Undefined 1=Acknowledged 2=Unacknowledged		
ALARM_STATE	21.2	RO		0=Undefined 1=Clear-reported 2=Clear-not reported 3=Active-reported 4=Active-not reported		
TIME_STAMP	21.3	RO				
SUBCODE	21.4	RO				
VALUE	21.5	RO				
Alarm Summary ALARM_SUM	22					Data Type: DS-74 Current alert status, unacknowledged states, unreported states, and disabled states of the alarms associated with the function block. 0=clear 0=acknowledged 0=reported 0=enabled
CURRENT	22.1	RO	ALL	0: Discrete alarm 1: Hi Hi alarm 2: Hi Alarm 3: Lo Lo Alarm 4: Lo Alarm 7: Block alarm		
UNACKNOWLEDGED	22.2	RO	ALL			
UNREPORTED	22.3	RO	ALL			
DISABLED	22.4	RW	ALL		All bits: 0	
Acknowledge Option ACK_OPTION	23		ALL	0: Discrete alarm 1: Hi Hi alarm 2: Hi Alarm 3: Lo Lo Alarm 4: Lo Alarm 7: Block alarm	All bits: 0	Data Type: Bit String 0=Disable 1=Enable Selection of whether alarms associated with the block will be automatically acknowledged.
Alarm Hysteresis ALARM_HYS	24		ALL	0 - 50%	0.50%	Data Type: Float Hysteresis on alarms.
High High Priority HI_HI_PRI	25		ALL	0 to 15	0	Data Type: Unsigned8 The priority of the hi hi alarm.
High High Limit HI_HI_LIM	26		ALL	OUT_SCALE	0	Data Type: Float Value of analog input which will generate an alarm.
High Priority HI_PRI	27		ALL	0 to 15	0	Data Type: Unsigned8 The priority of the high alarm.
Hi Limit HI_LIM	28		ALL	OUT_SCALE	0	Data Type: Float Value of analog input which will generate an alarm.
Low Priority LO_PRI	29		ALL	0 to 15	0	Data Type: Unsigned8 The priority of the low alarm.
Low Limit LO_LIM	30		ALL	OUT_SCALE	0	Data Type: Float Value of analog input which will generate an alarm.
Low Low Priority LO_LO_PRI	31		ALL	0 to 15	0	Data Type: Unsigned8 The priority of the low low alarm.
Low Low Limit LO_LO_LIM	32		ALL	OUT_SCALE	0	Data Type: Float Value of analog input which will generate an alarm.

-Continued-

Table B-5. Analog Input Block Parameter Definitions (Continued)

Label PARAMETER_NAME	Index Number	RO / RW	Write Block Mode	Range	Initial Value	Description
High High Alarm HI_HI_ALM	33					Data Type: DS-71 The status of the hi hi alarm and its associated time stamp.
UNACKNOWLEDGED	33.1	RW	NA		0	
ALARM_STATE	33.2	RO			0	
TIME_STAMP	33.3	RO			0	
SUBCODE	33.4	RO			0	
VALUE	33.5	RO			0	
High Alarm HI_ALM	34					Data Type: DS-71 The status of the hi alarm and its associated time stamp.
UNACKNOWLEDGED	34.1	RW	NA		0	
ALARM_STATE	34.2	RO			0	
TIME_STAMP	34.3	RO			0	
SUBCODE	34.4	RO			0	
VALUE	34.5	RO			0	
Low Alarm LO_ALM	35					Data Type: DS-71 The status of the lo alarm and its associated time stamp.
UNACKNOWLEDGED	35.1	RW	NA		0	
ALARM_STATE	35.2	RO			0	
TIME_STAMP	35.3	RO			0	
SUBCODE	35.4	RO			0	
VALUE	35.5	RO			0	
Low Low Alarm LO_LO_ALM	36					Data Type: DS-71 The status of the lo lo alarm and its associated time stamp.
UNACKNOWLEDGED	36.1	RW	NA		0	
ALARM_STATE	36.2	RO			0	
TIME_STAMP	36.3	RO			0	
SUBCODE	36.4	RO			0	
VALUE	36.5	RO			0	
Extended Parameter						
Output Discrete OUT_D	37		OOS, MAN	OUT_STATE		Data Type: DS-66 Discrete Output this is true (1) if any of the alarms selected in ALM_SEL are active.
Alarm Select ALM_SEL	38		ALL	1: Hi Hi alarm 2: Hi Alarm 3: Lo Lo Alarm 4: Lo Alarm	All bits: 0	Data Type: Bitstring 0=unselected 1=selected Selected alarms that activate the alarm output.
StdDev STDDEV	39	RO	NA	Positive float		Data Type: Float Standard deviation of the measurement.
Cap StdDev CAP_STDDEV	40	RO	NA	Positive float		Data Type: Float Capability standard deviation, the best deviation that can be achieved.

View Lists

View lists allow the values of a set of parameters to be accessed at the same time. Views 1 and 2 contain operating parameters and are defined by the Fieldbus Foundation. View 3 contains dynamic parameters and View 4 contains static parameters with configuration and maintenance information. Views 3 and 4 are defined by the manufacturer.

Table B-6. AI Function Block, View 1

Index Number	Parameter
1	ST_REV
5.1	MODE_BLK.TARGET_MODE
5.2	MODE_BLK.ACTUAL_MODE
5.3	MODE_BLK.PERMITTED_MODE
5.4	MODE_BLK.NORMAL_MODE
6	BLOCK_ERR
7	PV
8	OUT
19	FIELD_VAL
22.1	ALARM_SUM.CURRENT
22.2	ALARM_SUM.UNACKNOWLEDGED
22.3	ALARM_SUM.UNREPORTED
22.4	ALARM_SUM.DISABLED

Table B-7. AI Function Block, View 2

Index Number	Parameter
1	ST_REV
10	XD_SCALE
11	OUT_SCALE
12.1	GRANT_DENY.GRANT
12.2	GRANT_DENY.DENY

Table B-8. AI Function Block, View 3

Index Number	Parameter
1	ST_REV
5.1	MODE_BLK.TARGET_MODE
5.2	MODE_BLK.ACTUAL_MODE
5.3	MODE_BLK.PERMITTED_MODE
5.4	MODE_BLK.NORMAL_MODE
6	BLOCK_ERR
7	PV
8	OUT
19	FIELD_VAL
22.1	ALARM_SUM.CURRENT
22.2	ALARM_SUM.UNACKNOWLEDGED
22.3	ALARM_SUM.UNREPORTED
22.4	ALARM_SUM.DISABLED
37	OUT_D
38	ALM_SEL
39	STDDEV
40	CAP_STDDEV

Table B-9. AI Function Block, View 4

Index Number	Parameter
1	ST_REV
3	STRATEGY
4	ALERT_KEY
13	IO_OPTS
14	STATUS_OPTS
15	CHANNEL
16	L_TYPE
17	LOW_CUT
18	PV_FTIME
23	ACK_OPTION
24	ALARM_HYS
25	HI_HI_PRI
26	HI_HI_LIM
27	HI_PRI
28	HI_LIM
29	LO_PRI
30	LO_LIM
31	LO_LO_PRI
32	LO_LO_LIM

Field Communicator Menu Structure

ANALOG INPUT FUNCTION BLOCK

Quick Config
- AI Channel
- Linearization Type
- Transducer Scale: EU at 100%
- Transducer Scale: EU at 0%
- Transducer Scale: Units Index
- Transducer Scale: Decimal
- Output Scale: EU at 100%
- Output Scale: EU at 0%
- Output Scale: Units Index
- Output Scale: Decimal

Common Config
- Acknowledge Option
- Alarm Hysteresis
- Alert Key
- High High Limit
- High High Priority
- High Limit
- High Priority
- I/O Options
- Linearization Type
- Low Low Limit
- Low Low Priority
- Low Limit
- Low Priority
- Block Mode: Target
- Block Mode: Actual
- Block Mode: Permitted
- Block Mode: Normal
- Output Scale: EU at 100%
- Output Scale: EU at 0%
- Output Scale: Units Index
- Output Scale: Decimal
- Process Value Filter Time

Advanced Config
- Low Cutoff
- Simulate: Simulate Status
- Simulate: Simulate Value
- Simulate: Transducer Status
- Simulate: Transducer Value
- Simulate: Simulate En/Disable
- Static Revision
- Status Options
- Strategy
- Transducer Scale: EU at 100%
- Transducer Scale: EU at 0%
- Transducer Scale: Units Index
- Transducer Scale: Decimal

I/O Reference
- AI Channel

Connectors
- Output: Status
- Output: Value

Online
- Block Error
- Field Value: Status
- Field Value: Value
- Cascade Input: Status
- Cascade Input: Value
- Block Mode: Target
- Block Mode: Actual
- Block Mode: Permitted
- Block Mode: Normal
- Output: Status
- Output: Value
- Process Value: Status
- Process Value: Value

Status
- Block Error

Other
- Tag Description
- Grant Deny: Grant
- Grant Deny: Deny
- Update Event: Unacknowledged
- Update Event: Update State
- Update Event: Time Stamp
- Update Event: Static Rev
- Update Event: Relative Index
- Block Alarm: Unacknowledged
- Block Alarm: Alarm State
- Block Alarm: Time Stamp
- Block Alarm: Subcode
- Block Alarm: Value
- Alarm Summary: Current
- Alarm Summary: Unacknowledged
- Alarm Summary: Unreported
- Alarm Summary: Disabled
- High Alarm: Unacknowledged
- High Alarm: Alarm State
- High Alarm: Time Stamp
- High Alarm: Subcode
- High Alarm: Float Value
- High High Alarm: Unacknowledged
- High High Alarm: Alarm State
- High High Alarm: Time Stamp
- High High Alarm: Subcode
- High High Alarm: Float Value
- Low Alarm: Unacknowledged
- Low Alarm: Alarm State
- Low Alarm: Time Stamp
- Low Alarm: Subcode
- Low Alarm: Float Value
- Low Low Alarm: Unacknowledged
- Low Low Alarm: Alarm State
- Low Low Alarm: Time Stamp
- Low Low Alarm: Subcode
- Low Low Alarm: Float Value
- Alarm output: Status
- Alarm output: Value
- Alarm Select
- StdDev
- Cap StdDev

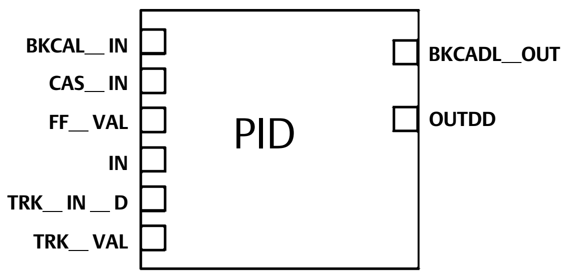
All
- Characteristics
- Static Revision
- Tag Description
- Strategy
- Alert Key
- Block Mode: Target
- Block Mode: Actual
- Block Mode: Permitted
- Block Mode: Normal
- Block Error
- Process Value: Status
- Process Value: Value
- Output: Status
- Output: Value
- Simulate: Simulate Status
- Simulate: Simulate Value
- Simulate: Transducer Status
- Simulate: Transducer Value
- Simulate: Simulate En/Disable
- Transducer Scale: EU at 100%
- Transducer Scale: EU at 0%
- Transducer Scale: Units Index
- Transducer Scale: Decimal
- Output Scale: EU at 100%
- Output Scale: EU at 0%
- Output Scale: Units Index
- Output Scale: Decimal
- Grant Deny: Grant
- Grant Deny: Deny
- I/O Options
- Status Options
- AI Channel
- Linearization Type
- Low Cutoff
- Process Value Filter TIme
- Field Value: Status
- Field Value: Value
- Update Event: Unacknowledged
- Update Event: Update State
- Update Event: Time Stamp
- Update Event: Static Rev
- Update Event: Relative Index
- Block Alarm: Unacknowledged
- Block Alarm: Alarm State
- Block Alarm: Time Stamp
- Block Alarm: Subcode
- Block Alarm: Value
- Alarm Summary: Current
- Alarm Summary: Unacknowledged
- Alarm Summary: Unreported
- Alarm Summary: Disabled
- Acknowledge Option

All (continued)
- Alarm Hysteresis
- High High Priority
- High High Limit
- High Priority
- High Limit
- Low Priority
- Low Limit
- Low Low Priority
- Low Low Limit
- High High Alarm: Unacknowledged
- High High Alarm: Alarm State
- High High Alarm: Time Stamp
- High High Alarm: Subcode
- High High Alarm: Float Value
- High Alarm: Unacknowledged
- High Alarm: Alarm State
- High Alarm: Time Stamp
- High Alarm: Subcode
- High Alarm: Float Value
- Low Alarm: Unacknowledged
- Low Alarm: Alarm State
- Low Alarm: Time Stamp
- Low Alarm: Subcode
- Low Alarm: Float Value
- Low Low Alarm: Unacknowledged
- Low Low Alarm: Alarm State
- Low Low Alarm: Time Stamp
- Low Low Alarm: Subcode
- Low Low Alarm: Float Value
- Alarm output: Status
- Alarm output: Value
- Alarm select
- StdDev
- Cap StdDev

PID Function Block

The PID function block (figure B-4) combines all of the necessary logic to perform proportional/integral/derivative (PID) control. The block supports mode control, signal scaling and limiting, feedforward control, override tracking, alarm limit detection, and signal status propagation.

Figure B-4. Proportional+Integral+Derivative (PID) Function Block



BKCAL_IN = THE ANALOG INPUT VALUE AND STATUS FROM ANOTHER BLOCK'S BKCAL _OUT OUTPUT THAT IS USED FOR BACKWARD OUTPUT TRACKING FOR BUMPLESS TRANSFER AND TO PASS LIMIT STATUS.

CAS_IN = THE REMOTE SETPOINT VALUE FROM ANOTHER FUNCTION BLOCK.

FF_VAL = THE FEEDFORWARD CONTROL INPUT VALUE AND STATUS.

IN = THE CONNECTION FOR THE PROCESS VARIABLEFROM ANOTHER FUNCTION BLOCK.

TRK_IN_D = INITIATES THE EXTERNAL TRACKING FUNCTION.

TRK_VAL = THE VALUE AFTER SCALING APPLIED TO OUT IN LOCAL OVERRIDE MODE.

BKCAL_OUT = THE VALUE AND STATUS REQUIRED BY THE BKCAL_IN INPUT OF ANOTHER FUNCTION BLOCK TO PREVENT RESET WINDUP AND TO PROVIDE BUMPLESS TRANSFER TO CLOSED LOOP CONTROL.

OUT = THE BLOCK OUTPUT AND STATUS.

B2720

The block supports two forms of the PID equation: Standard and Series. You can choose the appropriate equation using the MATHFORM [70] parameter. The Standard ISA PID equation is the default selection.

$$\text{Standard Out} = \text{GAIN} \times \text{ex} \times \left(1 + \frac{1}{\tau_r s + 1} + \frac{\tau_d s}{\propto \times \tau_d s + 1}\right) + \text{F}$$

$$\text{Series Out} = \text{GAIN} \times \text{ex} \times \left[\left(1 + \frac{1}{\tau_r s}\right) + \left(\frac{\tau_d s + 1}{\propto \times \tau_d s + 1}\right)\right] + \text{F}$$

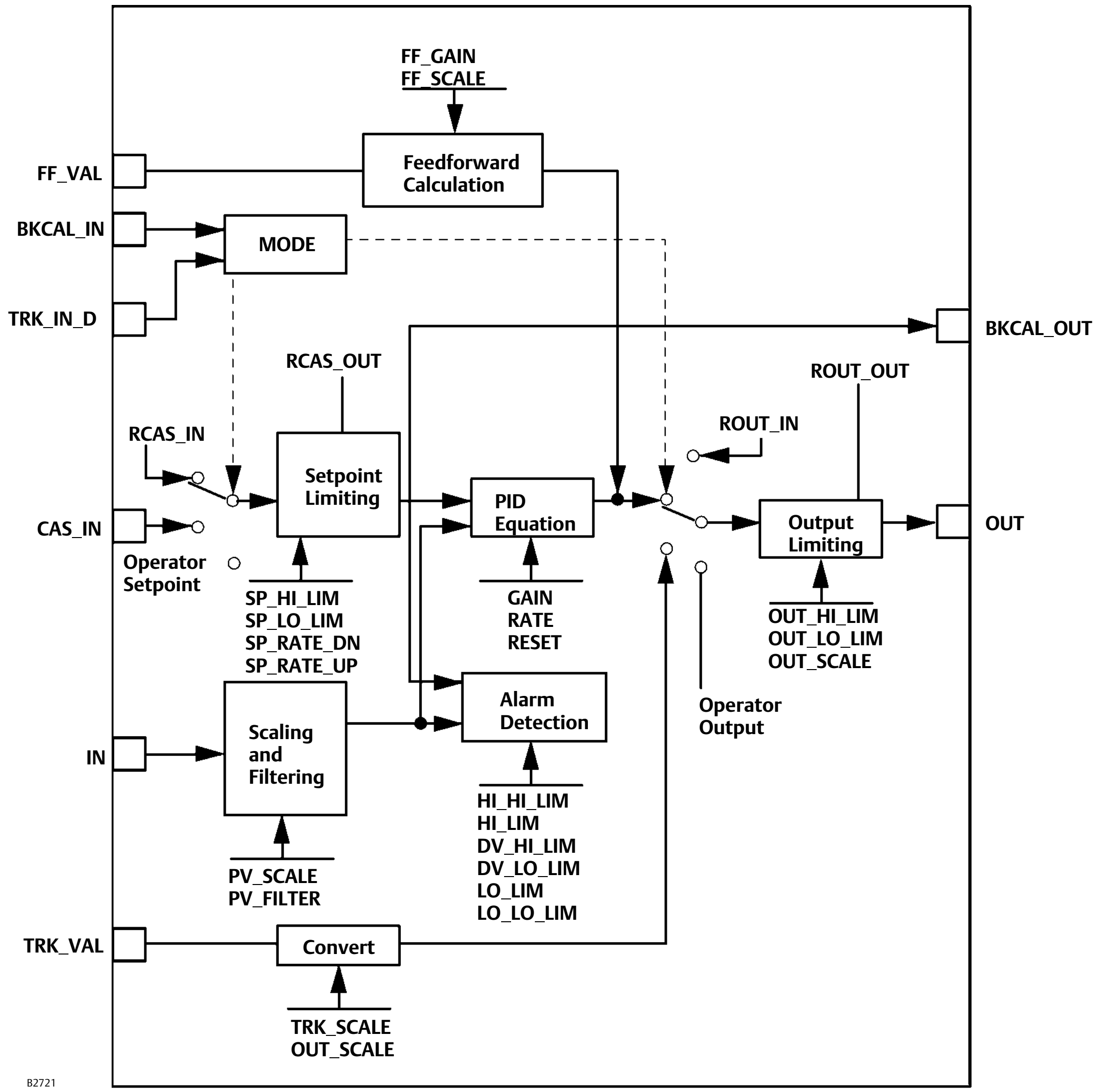
where

GAIN:	proportional gain value
τ_r:	integral action time constant (RESET parameter) in seconds
s:	laplace operator
τ_d:	derivative action time constant (RATE parameter)
α:	fixed smoothing factor of 0.1 applied to RATE
F:	feedforward control contribution from the feedforward input (FF_VAL)
E:	error between setpoint and process variable

To further customize the block for use in your application, you can configure filtering, feedforward inputs, tracking inputs, setpoint and output limiting, PID equation structures, and block output action. Table B-12 lists the PID block

parameters and their descriptions, units of measure, and index numbers, and figure B-5 illustrates the internal components of the PID function block.

Figure B-5. PID Function Block Schematic



Modes

The PID function block supports the following modes:

- Manual (Man)—The block output (OUT [9]) may be set manually.
- Automatic (Auto)—The SP [8] may be set manually and the block algorithm calculates OUT [9].
- Cascade (Cas)—The SP [8] is calculated in another block and is provided to the PID block through the CAS_IN [18] connection.
- RemoteCascade (RCas)—The SP [8] is provided by a host computer that writes to the RCAS_IN [32] parameter.

- **RemoteOutput (ROut)**—The OUT [9] is provided by a host computer that writes to the ROUT_IN [33] parameter.
- **Local Override (LO)**—The track function is active. OUT [9] is set by TRK_VAL [39]. The BLOCK_ERR [6] parameter shows Local override.
- **Initialization Manual (IMan)**—The output path is not complete (for example, the cascade-to-slave path might not be open). In IMan mode, OUT [9] tracks BKCAL_IN [27].
- **Out of Service (OOS)**—The block is not processed. The OUT [9] status is set to Bad: Out of Service. The BLOCK_ERR [6] parameter shows Out of service.

You can configure the Man, Auto, Cas, and OOS modes as permitted modes for operator entry.

Mode Handling

Shed Options—RCAS Mode Only

Shed from or climb to a remote mode is determined by the parameter SHED_OPT [34]. A block climbs and sheds through the same path. For example, if SHED_OPT [34] specifies that a block should shed to Auto, then, if the block target mode is set to RCas, the block goes through Auto on the way to RCas. You can configure the shed option as follows:

Shed With Return Options

Remote cascade or remote output connection failure shifts actual mode but keeps trying to restore remote cascade or remote output (in other words, the remote cascade or remote output target mode stays in effect).

Normal—On failure of a remote connection, the block attempts to attain the highest permitted non-remote mode until the remote connection is restored. Cas is the highest permitted non-remote mode and Auto is is the next highest permitted non-remote mode. If Cas or Auto are not available, the block will shed by default to Man.

Retained Target—The retained target mode is the mode the block was in before changing to one of the remote target modes. On failure of a remote connection, the block attempts to attain the retained target mode.

Auto—On failure of a remote connection, the block attempts to attain Auto, if permitted, until the remote connection is restored.

Man—On failure of a remote connection, the block sheds to Man until a remote connection is restored.

Shed With No Return Options

For any shed with no return option, the target mode changes as determined by the option. Therefore, there is no attempt to restore the connection following failure. The behavior on change to a remote target mode is identical to that for Shed With Return Options.

Normal—On failure of a remote connection, the block sets the target mode to the highest permitted non-remote mode. Cas is the highest permitted non-remote mode and Auto is is the next permitted non-remote mode. If Cas or Auto are not available, the block will shed by default to Man.

Retained Target—The retained target mode is the mode the block was in before changing to one of the remote target modes. On failure of a remote connection, the block sets the target mode to the retained target mode.

Auto—On failure of a remote connection, the block sets the target mode to Auto, if permitted.

Man—On failure of a remote connection, the block sets the target mode to Man, if permitted.

The user may configure SHED_OPTS [34] so that it calls for a target mode that is not permitted. When doing this, the mode logic uses the following rules as applied by the remote logic:

- Shed logic never results in a non-permitted target mode.
- Shed logic never attempts to attain an actual mode of Auto or Cas if that mode is not permitted.

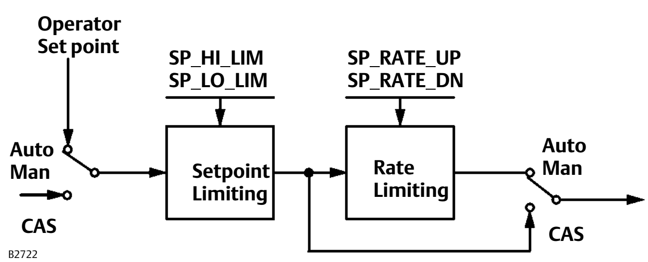
Status Handling

If the input status on the PID block is Bad, the mode of the block reverts to Manual. In addition, you can select the Target to Manual if Bad IN status option to direct the target mode to revert to manual. You can set the status option in Manual or Out of Service mode only.

Set Point Selection and Limiting

The set point of the PID block is only valid when the block is in Auto, Cas, or RCas. Figure B-6 illustrates the method for set point selection. You can configure the SP_HI_LIM [21] and SP_LO_LIM [22] parameters to limit the set point. In Cascade or Remote Cascade mode, the set point is adjusted by another function block or by a host computer, and the output is computed based on the set point.

Figure B-6. PID Function Block Set Point Selection



In Automatic mode, the set point is entered manually by the operator, and the output is computed based on the set point. In Auto mode, you can also adjust the set point limit and the set point rate of change using the SP_RATE_UP [20] and SP_RATE_DN [19] parameters.

In Manual mode the output is entered manually by the operator. In Remote Output mode, the output is entered by a host computer.

Output Selection and Limiting

Output selection is determined by the mode and the set point. In Automatic, Cascade, or Remote Cascade mode, the output is computed by the PID control equation. In Manual and Remote Output mode, the output may be entered manually (see also Set Point Selection and Limiting). You can limit the output by configuring the OUT_HI_LIM [28] and OUT_LO_LIM [29] parameters.

Filtering

The filtering feature changes the response time of the device to smooth variations in output readings caused by rapid changes in input. You can adjust the filter time constant (in seconds) using the PV_FTIME [16] or SP_FTIME [69] parameters. Set the filter time constant to zero to disable the filter feature.

Feedforward Calculation

The feedforward value (FF_VAL [40]) is scaled (FF_SCALE [41]) to a common range for compatibility with the output scale (OUT_SCALE [11]). A gain value (FF_GAIN [42]) is applied to achieve the total feedforward contribution.

Output Tracking

Output tracking is enabled through the control options. You can set control options in Manual or Out of Service mode only.

The Track Enable control option must be set to True for the track function to operate. When the Track in Manual control option is set to True, the operator cannot override the tracking function in Manual mode. When Track in Manual is False, the operator can override the tracking function when the block is in Manual mode. Activating the track function causes the block's actual mode to revert to Local Override.

The TRK_VAL [38] parameter specifies the value to be converted and tracked into the output when the track function is operating. The TRK_SCALE [37] parameter specifies the range of TRK_VAL [38].

When the TRK_IN_D [38] parameter is True and the Track Enable control option is True, the TRK_VAL [38] input is converted to the appropriate value and output in units of OUT_SCALE [11].

Set Point Tracking

You can configure the method for tracking the set point by configuring the following control options (CONTROL_OPTS [12]):

- **SP-PV Track in Man**—Permits the SP [8] to track the PV [7] when the actual mode of the block is Man.
- **SP-PV Track in LO or IMan**—Permits the SP [8] to track the PV [7] when the actual mode of the block is Local Override (LO) or Initialization Manual (IMan).
- **SP-PV Track in ROUT**—Permits the SP [8] to track the PV [7] when the actual mode of the block is RemoteOut (ROUT).
- **SP Track retained Target**—Causes the set point to track the RCAS or CAS parameter based on the retained target mode when the actual mode is MAN or LO.
- **Act On IR**—If this option is true, then when IR (Initialization Requested) is received on BKCAL_IN [27], the SP [8] will be adjusted within setpoint limits to provide bumpless transfer when the cascade is closed. If the setpoint required to provide bumpless transfer is outside the setpoint limits, then any difference added to provide bumpless transfer will be removed in the BAL_TIME [25].

When one of these options is set, the SP[8] value is set to the PV [7] value while in the specified mode.

You can select the value that a master controller uses for tracking by configuring the Use PV for BKCAL_OUT control option. The BKCAL_OUT [31] value tracks the PV value. BKCAL_IN [27] on a master controller connected to BKCAL_OUT [31] on the PID block in an open cascade strategy forces its OUT [9] to match BKCAL_IN [27], thus tracking the PV from the slave PID block into its cascade input connection (CAS_IN [18]). If the Use PV for BKCAL_OUT option is not selected, the working set point (SP_WRK [68]) is used for BKCAL_OUT [31].

You can set control options in Manual or Out of Service mode only. When the mode is set to Auto, the SP [8] will remain at the last value (it will no longer follow the PV [7].

PID Equation Structures for Enhanced PID Block

Note
Extended parameters are not available at this time for all host systems. Refer to your host system documentation, or contact your Emerson Process Management sales office for additional information.

Configure the STRUCTURECONFIG [71] parameter to select the PID equation structure. You can select one of the following choices:

- Proportional, integral, and derivative on error (PID)
- Proportional and integral on error, derivative on PV (PI_D)
- Integral on error, proportional and derivative on PV (I_PD)
- Proportional on error, derivative on error (PD)
- Integral on error, derivative on error (ID)
- Integral on error, derivative on PV (I_D)
- Two degrees of Freedom (2DOF)

Reverse and Direct Action

To configure the block output action, set the Direct Acting control option. This option defines the relationship between a change in PV [7] and the corresponding change in output. With Direct Acting enabled (True), an increase in PV results in an increase in the output.

You can set control options in Manual or Out of Service mode only.

Alarm Detection

A block alarm will be generated whenever the BLOCK_ERR [6] has an error bit set. The types of block error for the PID block are defined above.

Process alarm detection is based on the PV [7] value. You can configure the alarm limits of the following standard alarms:

- High (HI_LIM [51])
- High high (HI_HI_LIM [49])
- Low (LO_LIM [53])
- Low low (LO_LO_LIM [55])

Additional process alarm detection is based on the difference between SP [8] and PV [7] values and can be configured via the following parameters:

- Deviation high (DV_HI_LIM [57])
- Deviation low (DV_LO_LIM [59])

In order to avoid alarm chattering when the variable is oscillating around the alarm limit, an alarm hysteresis in percent of the PV span can be set using the ALARM_HYS [47] parameter. The priority of each alarm is set in the following parameters:

- HI_PRI [50]
- HI_HI_PRI [48]
- LO_PRI [52]
- LO_LO_PRI [54]
- DV_HI_PRI [56]
- DV_LO_PRI [58]

Alarms are grouped into five levels of priority, as shown in table B-10.

Table B-10. PID Function Block Alarm Priorities

Priority Number	Priority Description(1)
0	The alarm is disabled
1	An alarm condition with a priority of 1 can be recognized by the system. The device monitors the alarm but does not report it until requested by the host system.
2	An alarm condition with a priority of 2 is reported to the operator, but generally does not require operator attention (such as diagnostics and system alerts).
3-7	Alarm conditions of priority 3 to 7 are advisory alarms of increasing priority.
8-15	Alarm conditions of priority 8 to 15 are critical alarms of increasing priority.

1. The priority classes “advise” and critical” have no relationship to Plant Web Alerts.

Application Information

The PID function block is a powerful, flexible control algorithm that is designed to work in a variety of control strategies. The PID block is configured differently for different applications.

Block Errors

Table B-11 lists conditions reported in the BLOCK_ERR [6] parameter. Conditions in *italics* are not applicable for the PID block and are provided only for your reference.

Table B-11. BLOCK_ERR Conditions

Condition Number	Condition Name and Description
0	*Other (NA)*
1	**Block Configuration Error**—SHED_OPT or BYPASS set to 0
2	*Link Configuration Error (NA)*
3	*Simulate Active (NA)*
4	**Local Override**—The actual mode is LO and Track Enable is set.
5	*Device Fault State Set (NA)*
6	*Device Needs Maintenance Soon (NA)*
7	**Input failure/process variable has Bad status**—The parameter linked to IN is indicating a Bad status.
8	*Output Failure (NA)*
9	*Memory Failure (NA)*
10	*Lost Static Data (NA)*
11	*Lost NV Data (NA)*
12	*Readback Check Failed (NA)*
13	*Device Needs Maintenance Now (NA)*
14	**Power Up**—Set if devices was powered up with this block in Out of Service (OOS) mode. Cleared on first change of mode to other than OOS.
15	**Out of Service**—The actual mode is Out of Service (OOS).

PID Block Parameter List

- Read/Write Capability: RO - Read Only, RW - Read Write
- Mode: The block mode(s) required to write to the parameter
- Double indentation and shaded Index Number indicates sub-parameter

Table B-12. PID Function Block System Parameters Definitions

Label PARAMETER_NAME	Index Number	RO / RW	Block Mode	Range	Initial Value	Description
Static Revision ST_REV	1	RO	NA	0 to 65535	0	Data Type: Unsigned16 The revision level of the static data associated with the function block. The revision value will be incremented each time a static pa rameter value in the block is changed.
Tag Description TAG_DESC	2	RW	ALL	7 bit ASCII	Spaces	Data Type: Octet String The user description of the intended application of the block.
Strategy STRATEGY	3	RW	ALL	0 to 65535	0	Data Type: Unsigned16 The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.
Alert Key ALERT_KEY	4	RW	ALL	0 to 255	0	Data Type: Unsigned8 The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.
Block Mode MODE_BLK	5					Data Type: DS-69 Valid Bits: 7: OOS, 6: IMAN, 5: LO, 4: MAN, 3: AUTO, 2: CAS, 1: RCAS, 0: ROUT The actual, target, permitted, and normal modes of the block. Target: The requested block mode Actual: The current mode of the block Permitted: Allowed modes for Target Normal: Most common mode for Target
TARGET	5.1	RW	ALL	OOS, MAN, AUTO CAS, RCAS, ROUT	OOS until block is configured, then last valid target	
ACTUAL	5.2	RO	ALL		OOS	
PERMITTED	5.3	RW	ALL	OOS+MAN+AUTO+ CAS+RCAS+ROUT	OOS MAN, AUTO CAS, RCAS ROUT	
NORMAL	5.4	RW	ALL		AUTO	
Block Error BLOCK_ERR	6	RO	NA	Defined Bits 1: Block Configuration Error 4: Local Override 7: Input Failure/ Bad PV status 14: Power-up 15: Out-of-Service	Dynamic	Data Type: Bit String 0 = inactive 1 = active This parameter reflects the error status associated with the hardware or software components associated with a block. It is a bit string so that multiple errors may be shown.
Process Value PV	7	RO	NA		Dynamic	Data Type: DS-65 The process variable used in block execution.
Setpoint SP	8		OOS MAN AUTO	PV_SCALE +/- 10%	Dynamic	Data Type: DS-65 The target block setpoint value. It is the result of setpoint limiting and setpoint rate of change limiting.
Output OUT	9		MAN OOS	Status OUT_SCALE +/- 10% Value	Dynamic	DS-65 The block output value and status.
Process Value Scale PV_SCALE	10		OOS	EU at 100% EU at 0% Units index Decimal Point	100 0 % 2	Data Type: DS-68 The high and low scale values, engineering units code, and number of digits to the right of the decimal point associated with PV.
Output Scale OUT_SCALE	11		OOS	EU at 100% EU at 0%t Units index Decimal Point	100 0 % 2	Data Type: DS-68 The high and low scale values, engineering units code, and number of digits to the right of the decimal point associated with OUT.

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Table B-12. PID Function Block System Parameters Definitions (Continued)

Label PARAMETER_NAME	Index Number	RO / RW	Block Mode	Range	Initial Value	Description
Grant Deny GRANT_DENY	12					Data Type: DS-70 Options for controlling access of host computers and local control panels to operating, tuning, and alarm parameters of the block. Not used by the device. GRANT: 0=NA, 1=granted DENY: 0 = NA, 1= denied
GRANT	12.1		ALL	0: Program 1: Tune 2: Alarm 3: Local	All bits: 0	
DENY	12.2		ALL	0: Program 1: Tune 2: Alarm 3: Local	All bits: 0	
Control Options CONTROL_OPTS	13		OOS	0: Bypass Enable 1: SP tracks PV in MAN 2: SP tracks PV in ROUT 3: SP tracks PV in LO or MAN 4: SP tracks RCAS or CAS in IMAN, LO, MAN or ROUT 5: Direct Acting 7: Track Enable 8: Track in Manual 9: Use PV for BKCAL_OUT 10: Act on IR 12: Restrict SP to limits in Cas and RCas 13: No output limits in MAN	All bits: 0	Data Type: Bit String 0=disable 1=enable Allows you to specify control strategy options.
Status Options STATUS_OPTS	14		OOS	0: IFS (Initiate Fault State) if BAD IN 1: IFS if BAD CAS_IN 2: Use Uncertain as Good 5: Target to MAN if BAD IN	All bits: 0	Data Type: Bit String 0=disable 1=enable Allows you to select options for status handling and processing.
Input IN	15		ALL	Status	BAD: NC: const	Data Type: DS-65 The primary input value of the block.
				Value	0	
Process Value Filter Time PV_FTIME	16		ALL	Positive	0	Data Type: Float The time constant of the first-order PV filter. It is the time, in seconds, required for a 63 percent change in the IN value.
Bypass BYPASS	17		MAN OOS	1=Off 2=On	0=undefined	Data Type: Enum Used to override the calculation of the block. When enabled, the SP is sent directly to the output.
Cascade Input CAS_IN	18		ALL	Status	BAD NC: const	Data Type: DS-65 The setpoint value from another block.
				Value	0	
Setpoint Rate Down SP_RATE_DN	19		ALL	Positive	+ INF	Data Type: Float Ramp rate for downward SP changes. When the ramp rate is set to zero, the SP is used immediately. PV per second
Setpoint Rate UP SP_RATE_UP	20		ALL	Positive	+ INF	Data Type: Float Ramp rate for upward SP changes. When the ramp rate is set to zero, the SP is used immediately. PV per second
Setpoint High Limit SP_HI_LIM	21		ALL	PV Scale +/- 10%, must be greater than SP_LO_LIM	100	Data Type: Float The highest SP value allowed.
Setpoint Low Limit SP_LO_LIM	22		ALL	PV Scale +/- 10%, must be less than SP_HI_LIM	0	Data Type: Float The lowest SP value allowed.
Gain GAIN	23		ALL	greater than 0	1	Data Type: Float The proportional gain value.
Reset RESET	24		ALL	Positive	+ INF	Data Type: Float The integral action time constant. Seconds per repeat

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Table B-12. PID Function Block System Parameters Definitions (Continued)

Label PARAMETER_NAME	Index Number	RO / RW	Block Mode	Range	Initial Value	Description
Balance Time BAL_TIME	25		ALL	Positive	0	Data Type: Float The specified time, in seconds, for the internal working value of bias to return to the operator set bias. Also used to specify the time constant at which the integral term will move to obtain balance when the output is limited and the mode is AUTO, CAS, or RCAS.
Rate RATE	26		ALL	Positive	0	Data Type: Float The derivative action time constant, in seconds.
Back Calculation Input BKCAL_IN	27		ALL	Status	BAD: NC: const	Data Type: DS-65 The analog input value and status from another block's BKCAL_OUT output that is used for backward output tracking for bumpless transfer and to pass limit status.
				Value	0	
Output High Limit OUT_HI_LIM	28		ALL	OUT_SCALE +/- 10%	100	Data Type: Float Limits the maximum output value for modes other than manual.
Output Low Limit OUT_LO_LIM	29		ALL	OUT_SCALE +/- 10%	0	Data Type: Float Limits the minimum output value for modes other than manual.
Back Calculation Hysteresis BKCAL_HYS	30		ALL	0 to 50%	0.50%	Data Type: Float The amount the output value must change away from the its output limit before limit status is turned off.
Back Calculation Output BKCAL_OUT	31	RO	NA		Dynamic	Data Type: DS-65 The value and status required by the BKCAL_IN input of another block to prevent reset windup and to provide bumpless transfer of closed loop control.
Remote Cascade Input RCAS_IN	32		ALL	Status	BAD: NoCom: NoVal: const	Data Type: DS-65 Target setpoint and status that is provided by a supervisory host. Used when mode is RCAS.
				Value	0 Trk	
Remote Out Input ROUT_IN	33		ALL	Status	BAD: NoCom: NoVal: const	Data Type: DS-65 Target output and status that is provided by a supervisory host. Used when mode is ROUT.
				Value	0 Trk	
Shed Options SHED_OPT	34		ALL	0=Invalid 1=Normal Shed, Normal Return 2=Normal Shed, No Return 3=Shed to Auto, normal return 4=Shed to Auto, no return. Target mode changes to Auto on detection of a shed condition 5=Shed to Manual, normal return 6=Shed to Manual, No return. Target mode changes to MAN on detection of a shed condition. 7=Shed to retained target, normal return 8=Shed to retained target, no return. (Change target to retained target)	0=Invalid	Data Type: Uint8 Defines action to be taken on remote control device timeout. Normal Return - actual mode changes to the next lowest priority non-remote mode permitted but returns to the target remote mode when the remote computer completes the initialization handshake. No Return - Target mode changes to the next lowest priority non-remote mode permitted. The target remote mode is lost, so no return occurs.

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Table B-12. PID Function Block System Parameters Definitions (Continued)

Label PARAMETER_NAME	Index Number	RO / RW	Block Mode	Range	Initial Value	Description
Remote Cascade Output RCAS_OUT	35	RO	NA		Dynamic	Data Type: DS-65 Block setpoint and status after ramping, filtering, and limiting that is provided to a supervisory host for back calculation to allow action to be taken under limiting conditions or mode change. Used when mode is RCAS.
Remote Out Output ROUT_OUT	36	RO	NA		Dynamic	Data Type: DS-65 Block output that is provided to a supervisory host for a back calculation to allow action to be taken under limiting conditions or mode change. Used when mode is RCAS.
Tracking Scale TRK_SCALE	37		MAN OOS		100 0 % 2	Data Type: DS-68 The high and low scale values, engineering units code, and number of digits to the right of the decimal point associated with the external tracking value (TRK_VAL).
Tracking Input Discrete TRK_IN_D	38		ALL	Status	BAD: NC: const	Data Type: DS-66 Discrete input that initiates external tracking of the block output to the value specified by TRK_VAL.
				Value	0	
Tracking Value TRK_VAL	39		ALL	Status	BAD: NC: const	Data Type: DS-65 The value (after scaling from TRK_SCALE to OUT_SCALE) applied to OUT in LO mode when external tracking is enabled by TRK_IN_D.
				Value	0	
Feed Forward Value FF_VAL	40		ALL	Status	BAD: NC: const	Data Type: DS-65 The feedforward control input value and status.
				Value	0	
Feed Forward Scale FF_SCALE	41		MAN OOS		100 0 % 2	Data Type: DS-68 The high and low scale values, engineering units code, and number of digits to the right of the decimal point associated with the feedforward value (FF_VAL).
Feed Forward Gain FF_GAIN	42		MAN OOS		0	Data Type: Float The feedforward gain value. FF_VAL is multiplied by FF_GAIN before it is added to the calculated control output. A value of 0 disables feedforward.
Update Event UPDATE_EVT	43					Data Type: DS-73 This alert is generated by any changes to the static data.
UNACKNOWLEDGED	43.1	RW	NA	0=Undefined 1=Acknowledged 2=Unacknowledged	0	
UPDATE_STATE	43.2	RO	NA	0=Undefined 1=Update reported 2=Update not reported	0	
TIME_STAMP	43.3	RO	NA		0	
STATIC_REVISION	43.4	RO	NA		0	
RELATIVE_INDEX	43.5	RO	NA		0	
Block Alarm BLOCK_ALM	44					Data Type: DS-72 The block alarm is used for all configuration, hardware, connection failure, or system problems in the block. The cause of the alarm will be set in the subcode. VALUE Data Type: Unsigned8
UNACKNOWLEDGED	44.1	RW	NA	0=Undefined 1=Acknowledged 2=Unacknowledged	0	
ALARM_STATE	44.2	RO	NA	0=Undefined 1=Clear-reported 2=Clear-not reported 3=Active reported 4=Active not reported	0	
TIME_STAMP	44.3	RO	NA		0	
SUBCODE	44.4	RO	NA		0	
VALUE	44.5	RO	NA		0	

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Table B-12. PID Function Block System Parameters Definitions (Continued)

Label PARAMETER_NAME	Index Number	RO / RW	Block Mode	Range	Initial Value	Description
Alarm Summary ALARM_SUM	45					Data Type: DS-74 Current alert status, unacknowledged states, unreported states, and disabled states of the alarms associated with the function block.
CURRENT	45.1	RO	ALL	1: High High Alarm 2: High Alarm 3: Low Low Alarm 4: Low Alarm 5: Deviation High Alarm 6: Deviation Low Alarm 7: Block Alarm	Dynamic	
UNACKNOWLEDGED	45.2	RO	ALL			
UNREPORTED	45.3	RO	ALL			
DISABLED	45.4	RW	ALL			
Acknowledge Option ACK_OPTION	46		NA	1: High High Alarm 2: High Alarm 3: Low Low Alarm 4: Low Alarm 5: Deviation High Alarm 6: Deviation Low Alarm 7: Block Alarm	All bits: 0	Data Type: Bit String 0=Disable 1=Enable Used to set auto acknowledgment of alarms.
Alarm Hysteresis ALARM_HYS	47		ALL	0 to 50%	0.50%	Data Type: Float The amount the alarm value must return to within the alarm limit before the associated active alarm condition clears.
High High Priority HI_HI_PRI	48		ALL	0 to 15	0	Data Type: Unsigned8 The priority of the HI HI Alarm.
High High Limit HI_HI_LIM	49		ALL	PV_SCALE, or +INF	+INF	Data Type: Float The setting for the alarm limit used to detect the HI HI alarm condition.
High Priority HI_PRI	50		ALL	0 to 15	0	Data Type: Unsigned8 The priority of the HI alarm.
High Limit HI_LIM	51		ALL	PV_SCALE, or +INF	+INF	Data Type: Float The setting for the alarm limit used to detect the HI alarm condition.
Low Priority LO_PRI	52		ALL	0 to 15	0	Data Type: Unsigned8 The priority of the LO alarm.
Low Limit LO_LIM	53		ALL	PV_SCALE, or -INF	-INF	Data Type: Float The setting for the alarm limit used to detect the LO alarm condition.
Low Low Priority LO_LO_PRI	54		ALL	0 to 15	0	Data Type: Unsigned8 The priority of the LO LO alarm.
Low Low Limit LO_LO_LIM	55		ALL	PV_SCALE, or -INF	-INF	Data Type: Float The setting for the alarm limit used to detect the LO LO alarm condition.
Deviation High Priority DV_HI_PRI	56		ALL	0 to 15	0	Data Type: Unsigned8 The priority of the deviation high alarm.
Deviation High Limit DV_HI_LIM	57		ALL	PV_SCALE, or +INF	+INF	Data Type: Float The setting for the alarm limit used to detect the deviation high alarm condition.
Deviation Low Priority DV_LO_PRI	58		ALL	0 to 15	0	Data Type: Unsigned8 The priority of the deviation low alarm.
Deviation Low Limit DV_LO_LIM	59		ALL	-INF, or -PV span to 0	-INF	Data Type: Float The setting for the alarm limit use to detect the deviation low alarm condition.
High High Alarm HI_HI_ALM	60					Data Type: DS-71 The HI HI alarm data, which includes a value of the alarm, a timestamp of occurrence, and the state of the alarm. VALUE Data Type: Float
UNACKNOWLEDGED	60.1	RW	NA	0=Undefined 1=Acknowledged 2=Unacknowledged	0=undefined	
ALARM_STATE	60.2	RO	NA	0=Undefined 1=Clear reported 2=Clear not reported 3=Active reported 4=Active not reported	0=undefined	
TIME_STAMP	60.3	RO	NA		0	
SUBCODE	60.4	RO	NA		0	

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Table B-12. PID Function Block System Parameters Definitions (Continued)

Label PARAMETER_NAME	Index Number	RO / RW	Block Mode	Range	Initial Value	Description
VALUE	60.5	RO	NA		0	
High Alarm HI_ALM	61					Data Type: DS-71 The HI alarm data, which includes a value of the alarm, a timestamp of occurrence, and the state of the alarm. VALUE Data Type: Float
UNACKNOWLEDGED	61.1	RW	NA	0=Undefined 1=Acknowledged 2=Unacknowledged	0=undefined	
ALARM_STATE	61.2	RO	NA	0=Undefined 1=Clear reported 2=Clear not reported 3=Active reported 4=Active not reported	0=undefined	
TIME_STAMP	61.3	RO	NA		0	
SUBCODE	61.4	RO	NA		0	
VALUE	61.5	RO	NA		0	
Low Alarm LO_ALM	62					Data Type: DS-71 The LO alarm data, which includes a value of the alarm, a timestamp of occurrence, and the state of the alarm. VALUE Data Type: Float
UNACKNOWLEDGED	62.1	RW	NA	0=Undefined 1=Acknowledged 2=Unacknowledged	0=undefined	
ALARM_STATE	62.2	RO	NA	0=Undefined 1=Clear reported 2=Clear not reported 3=Active reported 4=Active not reported	0=undefined	
TIME_STAMP	62.3	RO	NA		0	
SUBCODE	62.4	RO	NA		0	
VALUE	62.5	RO	NA		0	
Low Low Alarm LO_LO_ALM	63					Data Type: DS-71 The LO LO alarm data, which includes a value of the alarm, a timestamp of occurrence, and the state of the alarm.
UNACKNOWLEDGED	63.1	RW	NA	0=Undefined 1=Acknowledged 2=Unacknowledged	0=undefined	
ALARM_STATE	63.2	RO	NA	0=Undefined 1=Clear reported 2=Clear not reported 3=Active reported 4=Active not reported	0=undefined	Data Type: DS-71 The LO LO alarm data, which includes a value of the alarm, a timestamp of occurrence, and the state of the alarm. VALUE Data Type: Float
TIME_STAMP	63.3	RO	NA		0	
SUBCODE	63.4	RO	NA		0	
VALUE	63.5	RO	NA		0	
Deviation High Alarm DV_HI_ALM	64					Data Type: DS-71 The DV HI alarm data, which includes a value of the alarm, a timestamp of occurrence, and the state of the alarm. VALUE Data Type: Float
UNACKNOWLEDGED	64.1	RW	NA	0=Undefined 1=Acknowledged 2=Unacknowledged	0=undefined	
ALARM_STATE	64.2	RO	NA	0=Undefined 1=Clear reported 2=Clear not reported 3=Active reported 4=Active not reported	0=undefined	
TIME_STAMP	64.3	RO	NA		0	
SUBCODE	64.4	RO	NA		0	
VALUE	64.5	RO	NA		0	

-Continued-

Table B-12. PID Function Block System Parameters Definitions (Continued)

Label PARAMETER_NAME	Index Number	RO / RW	Block Mode	Range	Initial Value	Description
Deviation Low Alarm DV_LO_ALM	65					Data Type: DS-71 The DV LO alarm data, which includes a value of the alarm, a timestamp of occurrence, and the state of the alarm. VALUE Data Type: Float
UNACKNOWLEDGED	65.1	RW	NA	0=Undefined 1=Acknowledged 2=Unacknowledged	0=undefined	
ALARM_STATE	65.2	RO	NA	0=Undefined 1=Clear reported 2=Clear not reported 3=Active reported 4=Active not reported	0=undefined	
TIME_STAMP	65.3	RO	NA		0	
SUBCODE	65.4	RO	NA		0	
VALUE	65.5	RO	NA		0	
Extended Parameters						
Bias BIAS	66		ALL	OUT_SCALE +/- 10%	0	Data Type: Float The bias value used to calculate output for a PD structure.
Error ERROR	67	RO	NA		Dynamic	Data Type: Float The error (SP-PV) used to determine the control action.
SP Work SP_WRK	68	RO	NA		Dynamic	Data Type: Float The working set point of the block after limiting and filtering is applied. EU of PV_SCALE
SP FTime SP_FTIME	69		ALL	Positive	0	Data Type: Float The time constant of the first-order SP filter. It is the time, in seconds, required for a 63 percent change in the IN value. Applied after SP rate limiting.
Math Form MATHFORM	70		OOS	0=Standard 1=Series	0=Standard	Data Type: Unsigned8 Selects equation form (series or standard)
Structureconfig STRUCTURECONFIG	71		OOS	0=PID terms on error 1=PI terms on error, D term on PV 2=I terms on error, PD term on PV 3=PD terms on error 4= P term on error, D term on PV 5=ID terms on error 6=I term on error, D term on PV 7=2 Deg. of Freedom PID	0=PID terms on error	Data Type: Unsigned8 Defines PID equation structure to apply controller action.
UGamma GAMMA (ugamma)	72		OOS	> = 0, < = 1	1.0	Data Type: Float Fraction of derivative action taken on error versus PV. For a value of 0.6, then 60% of the derivative action will be based on error and 40% on PV. The value of GAMMA may be changed over a range of 0-1 if STRUCTURE is set to Two Degrees of Freedom Control. Otherwise, it is automatically set to a value of 1 or 0 based on the Structure selection.
UBeta BETA (ubeta)	73		OOS	> = 0, < = 1	1.0	Data Type: Float Fraction of proportional action taken on error versus PV. For a value of 0.6, then 60% of the proportional action will be based on error and 40% on PV. The value of BETA may be changed over a range of 0-1 if STRUCTURE is set to Two Degrees of Freedom Control. Otherwise, it is automatically set to a value of 1 or 0 based on the Structure selection.

-Continued-

Table B-12. PID Function Block System Parameters Definitions (Continued)

Label PARAMETER_NAME	Index Number	RO / RW	Block Mode	Range	Initial Value	Description
IDeadBand IDEADBAND	74		OOS	Positive	0	Data Type: Float Integral action stops when ERROR is within IDEADBAND, proportional and derivative action continue. EU of PV_SCALE
StdDev STDDEV	75	RO	NA		Dynamic	Data Type: Float Standard deviation of PV.
Cap StdDev CAP_STDDEV	76	RO	NA		Dynamic	Data Type: Float Standard deviation of PV changes.
T Request T_REQUEST	77	RO	ALL	0=Request Tuning 1=Force Tuning 2=Reset Tuner	0	Data Type: Bit String Operator request to initiate/control autotuning.
T State T_STATE	78	RO	NONE		0	Data Type: Unsigned8 Current autotuner state.
T Status T_STATUS	79	RO	NA	0=Scan Rate Too Low Warning 1=Insufficient Process Response (obsolete) 2=Scan Rate Too High Warning 3=Inverse Direct Acting Error 4=PV Deviation Too Large 5=Initial PV Deviation Too Large 6=PV Limited or Constant 7=PV Bad 8=Invalid Mode for Tuning 9=BKCAL_IN Non Good or Limited 10=Out Limited 11=Bypass Active 12=Mode Changed 13=Tracking Active 14=Disconnected 15=SP Changed	0	Data Type: Bit String Autotuner status.
T Ipgain T_IPGAIN	80	RO	NA		0.0	Data Type: Float Integrated process gain.
T Ugain T_UGAIN	81	RO	NA		0.0	Data Type: Float Ultimate gain.
T Uperiod T_UPERIOD	82	RO	NA		0.0	Data Type: Float Ultimate period.
T Psgain T_PSGAIN	83	RO	NA		0.0	Data Type: Float Process static gain.
T Ptimec T_PTIMEC	84	RO	NA		0.0	Data Type: Float Process time constant.
T Pdtime T_PDTIME	85	RO	NA		0.0	Data Type: Float Process dead time.
T Targetop T_TARGETOP	86		ALL		2	Data Type: Unsigned8 Target oscillation periods.
T Hyster T_HYSTER	87		ALL	> = 0.0	0.0	Data Type: Float Hysteresis
T Relayss T_RELAYSS	88		ALL	> = 0.0	3.0	Data Type: Float Relay step size.
T Gain Magnifier T_GAIN_MAGNIFIER	89		ALL	> 0.1, < 100	1.0	Data Type: Float Scales amount of gain.
T Auto Extra DT T_AUTO_EXTRA_DT	90		ALL		0	Data Type: Unsigned8 Allow additional cycle with extra deadtime.
T Auto Hysteresis T_AUTO_HYSTERESIS	91		ALL		0	Data Type: Unsigned8 Allows calculation of hysteresis based on CAP_STDDEV
T Aoperiods T_AOPERIODS	92	RO	NA		0	Data Type: Unsigned8 Actual oscillation periods.

View Lists

View lists allow the values of a set of parameters to be accessed at the same time. Views 1 and 2 contain operating parameters and are defined by the Fieldbus Foundation. View 3 contains dynamic parameters and View 4 contains static parameters with configuration and maintenance information. Views 3 and 4 are defined by the manufacturer.

Table B-13. PID Function Block, View 1

Index Number	Parameter
1	ST_REV
5.1	MODE_BLK.TARGET_MODE
5.2	MODE_BLK.ACTUAL_MODE
5.3	MODE_BLK.PERMITTED_MODE
5.4	MODE_BLK.NORMAL_MODE
6	BLOCK_ERR
7	PV
8	SP
9	OUT
18	CAS_IN
38	TRK_IN_D
39	TRK_VAL
45.1	ALARM_SUM.CURRENT
45.2	ALARM_SUM.UNACKNOWLEDGED
45.3	ALARM_SUM.UNREPORTED
45.4	ALARM_SUM.DISABLED

Table B-14. PID Function Block, View 2

Index Number	Parameter
1	ST_REV
10	PV_SCALE
11	OUT_SCALE
12.1	GRANT_DENY.GRANT
12.2	GRANT_DENY.DENY
17	BYPASS
21	SP_HI_LIM
22	SP_LO_LIM
28	OUT_HI_LIM
29	OUT_LO_LIM

Table B-15. PID Function Block, View 3

Index Number	Parameter
1	ST_REV
5.1	MODE_BLK.TARGET_MODE
5.2	MODE_BLK.ACTUAL_MODE
5.3	MODE_BLK.PERMITTED_MODE
5.4	MODE_BLK.NORMAL_MODE
6	BLOCK_ERR
7	PV
8	SP
9	OUT
15	IN
18	CAS_IN
27	BKCAL_IN
31	BKCAL_OUT
32	RCAS_IN
33	ROUT_IN
35	RCAS_OUT
36	ROUT_OUT
38	TRK_IN_D
39	TRK_VAL
40	FF_VAL
45.1	ALARM_SUM.CURRENT
45.2	ALARM_SUM.UNACKNOWLEDGED
45.3	ALARM_SUM.UNREPORTED
45.4	ALARM_SUM.DISABLED
67	ERROR
68	SP_WORK
71	STRUCTURECONFIG
75	STDDEV
76	CAP_STDDEV

Note
Because individual views are limited in size, View List 4 has two parts.

Table B-16. PID Function Block, View 4.1

Index Number	Parameter
1	ST_REV
3	STRATEGY
4	ALERT_KEY
13	CONTROL_OPTS
14	STATUS_OPTS
16	PV_FTIME
19	SP_RATE_DN
20	SP_RATE_UP
23	GAIN
24	RESET
25	BAL_TIME
26	RATE
30	BKCAL_HYS
34	SHED_OPT
37	TRK_SCALE
41	FF_SCALE
42	FF_GAIN
46	ACK_OPTION
47	ALARM_HYS
48	HI_HI_PRI
49	HI_HI_LIM
50	HI_PRI
51	HI_LIM
52	LO_PRI
53	LO_LIM
54	LO_LO_PRI
55	LO_LO_LIM
56	DV_HI_PRI
57	DV_HI_LIM
58	DV_LO_PRI
59	DV_LO_LIM

Table B-17. PID Function Block, View 4.2

Index Number	Parameter
1	ST_REV
66	BIAS
69	SP_FTIME
70	MATHFORM
71	STRUCTURECONFIG
72	GAMMA (ugamma)
73	BETA
74	IDEADBAND

Field Communicator Menu Structure

PID FUNCTION BLOCK

Quick Config
- Alert Key
- Control Options
- Deviation High Limit
- Deviation Low Limit
- Gain
- High High Limit
- High Limit
- Low Limit
- Low Low Limit
- Output Scale: EU at 100%
- Output Scale: EU at 0%
- Output Scale: Units Index
- Output Scale: Decimal
- Process Value Scale: EU at 100%
- Process Value Scale: EU at 0%
- Process Value Scale: Units Index
- Process Value Scale: Decimal
- Reset
- Setpoint: Status
- Setpoint: Value
- Setpoint High Limit
- Setpoint Low Limit

Common Config
- Alarm Hysteresis
- Alert Key
- Control Options
- Deviation High Limit
- Deviation Low Limit
- Gain
- High High Limit
- High Limit
- Low Limit
- Low Low Limit
- Block Mode: Target
- Block Mode: Actual
- Block Mode: Permitted
- Block Mode: Normal
- Output High Limit
- Output Low Limit
- Output Scale: EU at 100%
- Output Scale: EU at 0%
- Output Scale: Units Index
- Output Scale: Decimal
- Process Value Filter Time
- Process Value Scale: EU at 100%
- Process Value Scale: EU at 0%
- Process Value Scale: Units Index
- Process Value Scale: Decimal
- Rate
- Reset
- Setpoint: Status
- Setpoint: Value
- Setpoint High Limit
- Setpoint Low Limit

Advanced Config
- Back Calculation Hysteresis
- Feed Forward Gain
- Feed Forward Scale: EU at 100%
- Feed Forward Scale: EU at 0%
- Feed Forward Scale: Units Index
- Feed Forward Scale: Decimal
- Shed Options
- Setpoint Rate Down
- Setpoint Rate Up
- Static Revision
- Status Options
- Strategy
- Tracking Scale: EU at 100%
- Tracking Scale: EU at 0%
- Tracking Scale: Units Index
- Tracking Scale: Decimal
- Tracking Value: Status
- Tracking Value: Value

Connectors
- Back Calculation Input: Status
- Back Calculation Input: Value
- Back Calculation Output: Status
- Back Calculation Output: Value
- Cascade Input: Status
- Cascade Input: Value
- Feed Forward Value: Status
- Feed Forward Value: Value
- Input: Status
- Input: Value
- Output: Status
- Output: Value
- Tracking Input Discrete: Status
- Tracking Input Discrete: Value
- Tracking Value: Status
- Tracking Value: Value

Online
- Back Calculation Input: Status
- Back Calculation Input: Value
- Back Calculation Output: Status
- Back Calculation Output: Value
- Block Error
- Bypass
- Cascade Input: Status
- Cascade Input: Value
- Feed Forward Value: Status
- Feed Forward Value: Value
- Gain
- Input: Status
- Input: Value
- Block Mode: Target
- Block Mode: Actual
- Block Mode: Permitted
- Block Mode: Normal
- Output: Status
- Output: Value
- Process Value: Status
- Process Value: Value
- Remote Cascade Input: Status
- Remote Cascade Input: Value
- Remote Cascade Output: Status
- Remote Cascade Output: Value
- Remote Out Input: Status
- Remote Out Input: Value
- Remote Out Output: Status
- Remote Out Output: Value
- Setpoint: Status
- Setpoint: Value
- Tracking Input Discrete: Status
- Tracking Input Discrete: Value
- Tracking Value: Status
- Tracking Value: Value

Status
- Block Error

(menu continued on next page)

PID FUNCTION BLOCK (continued)

Other

- Tag Description
- Grant Deny: Grant
- Grant Deny: Deny
- Balance Time
- Update Event: Unacknowledged
- Update Event: Update State
- Update Event: Time Stamp
- Update Event: Static Rev
- Update Event: Relative Index
- Block Alarm: Unacknowledged
- Block Alarm: Alarm State
- Block Alarm: Time Stamp
- Block Alarm: Subcode
- Block Alarm: Value
- Alarm Summary: Current
- Alarm Summary: Unacknowledged
- Alarm Summary: Unreported
- Alarm Summary: Disabled
- Acknowledge Option
- High High Alarm: Unacknowledged
- High High Alarm: Alarm State
- High High Alarm: Time Stamp
- High High Alarm: Subcode
- High High Alarm: Float Value
- High Alarm: Unacknowledged
- High Alarm: Alarm State
- High Alarm: Time Stamp
- High Alarm: Subcode
- High Alarm: Float Value
- Low Alarm: Unacknowledged
- Low Alarm: Alarm State
- Low Alarm: Time Stamp
- Low Alarm: Subcode
- Low Alarm: Float Value
- Low Low Alarm: Unacknowledged
- Low Low Alarm: Alarm State
- Low Low Alarm: Time Stamp
- Low Low Alarm: Subcode
- Low Low Alarm: Float Value
- Deviation High Alarm: Unacknowledged
- Deviation High Alarm: Alarm State
- Deviation High Alarm: Time Stamp
- Deviation High Alarm: Subcode
- Deviation High Alarm: Float Value
- Deviation Low Alarm: Unacknowledged
- Deviation Low Alarm: Alarm State
- Deviation Low Alarm: Time Stamp
- Deviation Low Alarm: Subcode
- Deviation Low Alarm: Float Value
- Bias

Other (continued)

- Error
- SP Work
- SP FTime
- mathform
- structureconfig
- Ugamma
- UBeta
- IDeadBand
- StdDv
- Cap StdDev
- T Request
- T State
- T Status

Other (continued)

- T Ipgain
- T Ugain
- T Uperiod
- T Psgain
- T Ptimec
- T Pdtime
- T Targetop
- T Hyster
- T Relayss
- T Gain Magnifier
- T Auto Extra DT
- T Auto Hysteresis
- T Aoperiods

All

- Characteristics: Block Tag
- Static Revision
- Tag Description
- Strategy
- Alert Key
- Block Mode: Target
- Block Mode: Actual
- Block Mode: Permitted
- Block Mode: Normal
- Block Error
- Process Value: Status
- Process Value: Value
- Setpoint: Status
- Setpoint: Value
- Output: Status
- Output: Value
- Process Value Scale: EU at 100%
- Process Value Scale: EU at 0%
- Process Value Scale: Units Index
- Process Value Scale: Decimal
- Output Scale: EU at 100%
- Output Scale: EU at 0%
- Output Scale: Units Index
- Output Scale: Decimal
- Grant Deny: Grant
- Grant Deny: Deny
- Control Options
- Status Options
- Input: Status
- Input: Value
- Process Value Filter Time
- Bypass
- Cascade Input: Status
- Cascade Input: Value
- Setpoint Rate Down
- Setpoint Rate Up
- Setpoint High Limit
- Setpoint Low Limit
- Gain
- Reset
- Balance Time
- Rate
- Back Calculation Input: Status
- Back Calculation Input: Value
- Output High Limit
- Output Low Limit
- Back Calculation Hysteresis
- Back Calculation Output: Status
- Back Calculation Output: Value
- Remote Cascade Input: Status
- Remote Cascade Input: Value
- Remote Out Input: Status
- Remote Out Input: Value
- Shed Options
- Remote Cascade Output: Status
- Remote Cascade Output: Value
- Remote Out Output: Status
- Remote Out Output: Value
- Tracking Scale: EU at 100%
- Tracking Scale EU at 0%
- Tracking Scale: Units Index
- Tracking Scale: Decimal
- Tracking Input Discrete: Status
- Tracking Input Discrete: Value
- Tracking Value: Status
- Tracking Value: Value
- Feed Forward Value: Status
- Feed Forward Value: Value
- Feed Forward Scale: EU at 100%
- Feed Forward Scale: EU at 0%
- Feed Forward Scale: Units Index
- Feed Forward Scale: Decimal
- Feed Forward Gain

All (continued)

- Updated Event: Unacknowledged
- Update Event: Update State
- Update Event: Time Stamp
- Update Event: Static Rev
- Update Event: Relative Index
- Block Alarm: Unacknowledged
- Block Alarm: Alarm State
- Block Alarm: Time Stamp
- Block Alarm: Subcode
- Block Alarm: Value
- Alarm Summary: Current
- Alarm Summary: Unacknowledged
- Alarm Summary: Unreported
- Alarm Summary: Disabled
- Acknowledge Option
- Alarm Hysteresis
- High High Priority
- High High Limit
- High Priority
- High Limit
- Low Priority
- Low Limit
- Low Low Priority
- Low Low Limit
- Deviation High Priority
- Deviation High Limit
- Deviation Low Priority
- Deviation Low Limit
- High High Alarm: Unacknowledged
- High High Alarm: Alarm State
- High High Alarm: Time Stamp
- High High Alarm: Subcode
- High High Alarm: Float Value
- High Alarm: Unacknowledged
- High Alarm: Alarm State
- High Alarm: Time Stamp
- High Alarm: Subcode
- High Alarm: Float Value
- Low Alarm: Unacknowledged
- Low Alarm: Alarm State
- Low Alarm: Time Stamp
- Low Alarm: Subcode
- Low Alarm: Float Value
- Low Low Alarm: Unacknowledged
- Low Low Alarm: Alarm State
- Low Low Alarm: Time Stamp
- Low Low Alarm: Subcode
- Low Low Alarm: Float Value
- Deviation High Alarm: Unacknowledged
- Deviation High Alarm: Alarm State
- Deviation High Alarm: Time Stamp
- Deviation High Alarm: Subcode
- Deviation High Alarm: Float Value
- Deviation Low Alarm: Unacknowledged
- Deviation Low Alarm: Alarm State
- Deviation Low Alarm: Time Stamp
- Deviation Low Alarm: Subcode
- Deviation Low Alarm: Float Value
- Bias
- Error
- SP Work
- SP FTime
- mathform
- structureconfig
- UGamma
- UBeta
- IDeadBand
- StdDev

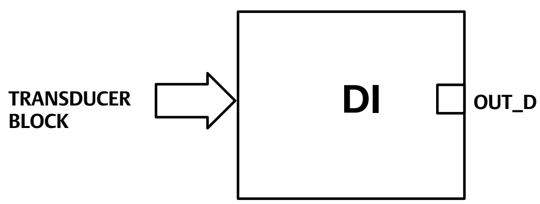
All (continued)

- Cap StdDev
- T Request
- T State
- T Status
- T Ipgain
- T Ugain
- T Uperiod
- T Psgain
- T Ptimec
- T Pdtime
- T Targetop
- T Hyster
- T Relayss
- T Gain Magnifier
- T Auto Extra DT
- T Auto Hysteresis
- T Aoperiods

Discrete Input (DI) Function Block

The Discrete Input (DI) function block (figure B-7) processes a single discrete input from a field device and makes it available to other function blocks. You can configure inversion and alarm detection on the input value. In the DLC2030f, the discrete input function block can provide level switch functionality. The DI function block supports mode control, signal status propagation, and simulation.

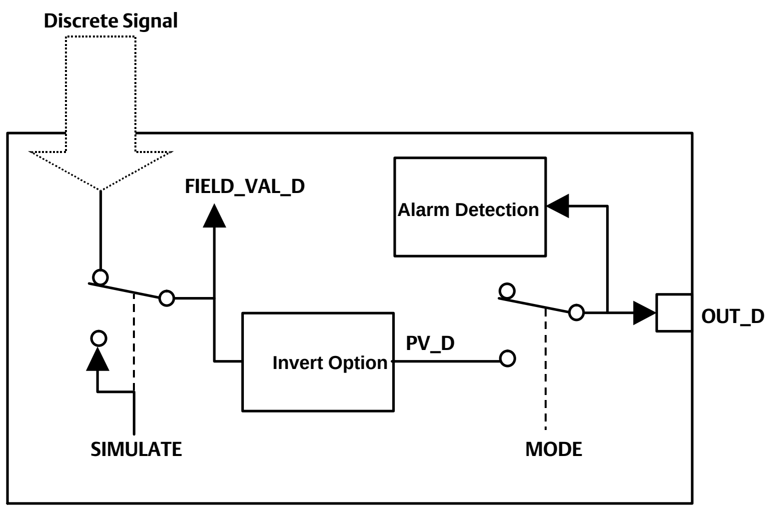
Figure B-7. Discrete Input (DI) Function Block



Normally, the block is used in Automatic mode so that the process variable (PV_D [7]) is copied to the output (OUT_D [8]). You can change the mode to Manual to disconnect the field signal and substitute a manually-entered value for the output. In this case, PV_D [7] continues to show the value that will become the OUT_D [8] when the mode is changed to Automatic.

To support testing, you can enable simulation, which allows the measurement value to be supplied manually through the SIMULATE_D [9] parameter. Figure B-8 illustrates the internal components of the DI function block, and table B-20 lists the definitions of the block parameters.

Figure B-8. Discrete Input Function Block Schematic



Modes

The Discrete Input function block supports the following modes:

- Manual (Man)—The block output (OUT_D [8]) is disconnected from the field and set manually.
- Automatic (Auto)—The block algorithm determines output.
- Out of Service (OOS)—The block is not processed. The OUT_D [8] status is set to Bad: Out of Service. The BLOCK_ERR [6] parameter shows Out of Service.

Block Initialization

The Fieldbus Foundation specification requires that certain parameters in the function blocks have initial values of uninitialized. In addition to setting the Resource block mode to AUTO, the control system or the user must change those parameters from their uninitialized value to a valid value in order for the function block to move from the Out of Service mode. For the DI function block, the CHANNEL [15] parameter must be initialized.

Status Handling

Under normal conditions, a Good: Non-Cascade status is passed through to OUT_D [8]. The block also supports the Status Action On Failure and BLOCK_ERR [6] indications.

When SIMULATE_D [9] is enabled, FIELD_VAL_D [7], PV_D [7], and OUT_D [8] change to the simulated status. When the block is set to Manual mode, OUT_D [7] is set to Good: Non-cascade, Constant status.

I/O Selection

To select the I/O associated with the discrete measurement, configure the value of the CHANNEL [15] parameter.

There are two channels associated with the DI function block in the digital level controller

- DI_1 (OUT)
- DI_2 (OUT)

The CHANNEL [15] parameter for the two DI blocks available in the digital level controller may be set independently to achieve the desired level position detection. The channels are selectable for rising and/or falling trigger points, as shown in figure B-9. The DI block CHANNEL [15] definitions are listed in table B-18. Refer to the following descriptions for details of the operation of these channels.

Figure B-9. Discrete Input Proximity Detection Function (Snap Acting Controller)

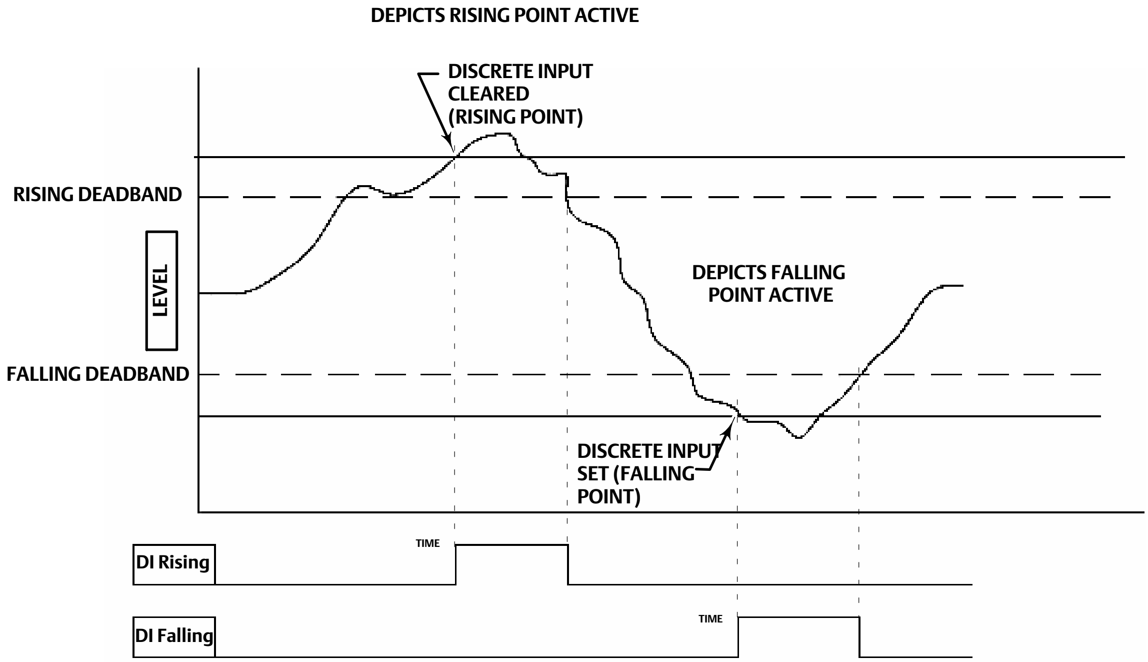


Table B-18. Channel Selection for the Discrete Input Function Block

Selection	Transducer Block Parameter(1)	Transducer Block Index Number	Bit Number(2)
6	DI_1_READBACK	47	0: Not active, 1: Active
7	DI_2_READBACK	51	0: Not active, 1: Active

1. Refer to table B-54 for parameter descriptions.

Field Value Processing

The Invert bit of the IO_OPTS [13] parameter may be used to logically invert the value of FIELD_VAL_D [17] before it is stored as PV_D [7]. PV_FTIME [16] may

be used to set the length of time that FIELD_VAL_D [17] must be in a new state before that new state is reflected in PV_D. The PV_D [7] value goes to the mode switch where it becomes OUT_D [8] when the actual mode is AUTO. OUT_D [8] is also tested for an alarm state.

Note

Invert is the only I/O option that the DI block supports. You can set the I/O option only when the block mode is Out of Service.

Alarm Detection

To select the state that initiates an input alarm, and to set discrete alarm substatus in the output, configure the DISC_LIM [23] parameter. You can enter any value between 0 and 255. A value of 255 disables the alarm. When OUT_D [8] matches the DISC_LIM [23] state, the discrete value of an alarm is set.

Block Errors

Table B-19 lists conditions reported in the BLOCK_ERR [6] parameter. Conditions in *italics* are not applicable for the DI block and are provided only for your reference.

Table B-19. BLOCK_ERR Conditions

Condition Number	Condition Name and Description
0	*Other (NA)*
1	**Block Configuration Error**—CHANNEL set to 0 through 10 (uninitialized)
2	*Link Configuration Error (NA)*
3	**Simulate Active**—Simulate is enabled. Output does not reflect process conditions
4	*Local Override (NA)*
5	*Device Fault State Set (NA)*
6	*Device Needs Maintenance Soon (NA)*
7	**Input failure/process variable has Bad status**—The hardware is bad or the transducer block mode is Out of Service
8	*Output Failure (NA)*
9	*Memory Failure (NA)*
10	*Lost Static Data (NA)*
11	*Lost NV Data (NA)*
12	*Readback Check Failed (NA)*
13	*Device Needs Maintenance Now (NA)*
14	**Power Up**—Set after power-up until actual mode is not Out of Service
15	**Out of Service**—The actual mode is Out of Service (OOS). The block is not being processed.

Action on Failure

In case of hardware failure, FIELD_VAL_D [17], PV_D [7], and OUT_D [8] change to a Bad status and the BLOCK_ ERR [6] parameter shows Process Variable has Bad Status. If the transducer block mode is Out of Service, the status of FIELD_VAL_D [17], PV_D [7], and OUT_D [8] is set to Bad:Out of Service.

Simulation

To support testing of the control strategy, you can enable the SIMULATE_D [9] parameter. Normally the measurement value and status used for FIELD_VAL_D [17] in the DI block reflect actual process values as provided by the transducer block. When the SIMULATE_D [9] parameter is enabled, value and status used for FIELD_VAL_D [17] is supplied by the user manually. To enable simulation in the DI function block, the simulate jumper must be installed. For information on the installation of this jumper, see the Installation section.

The SIMULATE_D [9] parameter has three components:

- Simulate_D enable/disable determines whether the function block will use the actual process value and status, or Simulate Value and Simulate Status.
- Transducer Value and Status reflect the process values provided by the transducer block.
- Simulate Value and Status may be entered by the user when enable/disable is set to enabled.

To use simulate, first install the simulate jumper in the terminal box, then set Simulate_D enable/disable to enabled, then enter the desired values for Simulate Value and Status.

When SIMULATE_D [9] is enabled, the Simulate Active bit of the BLOCK_ERR [6] parameter is set (refer to the Block Errors description). When the simulate jumper is installed, the Simulate Jumper bit of the transducer block parameter SELFTEST_STATUS [78] is set.

Discrete Input Function Block Parameter List

- Read/Write Capability: RO - Read Only, RW - Read Write
- Mode: The block mode(s) required to write to the parameter
- Double indentation and shaded Index Number indicates sub-parameter

Table B-20. Discrete Input Function Block Parameter Definitions

Label PARAMETER_NAME	Index Number	RO / RW	Block Mode	Range	Initial Value	Description
Static Revision ST_REV	1	RO	NA	0 to 65535	0	Data Type: Unsigned16 The revision level of the static data associated with the function block. The revision value will be incremented each time a static parameter value in the block is changed.
Tag Description TAG_DESC	2	RW	ALL	7 bit ASCII	Spaces	Data Type: Octet String The user description of the intended application of the block.
Strategy STRATEGY	3	RW	ALL	0 to 65535	0	Data Type: Unsigned16 The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.
Alert Key ALERT_KEY	4	RW	ALL	1 to 255	0	Data Type: Unsigned8 The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.
Block Mode MODE_BLK	5					Data Type: DS-69 Valid Bits: 7:OOS, 4:MAN, 3:AUTO The actual, target, permitted, and normal modes of the block. Target: The requested block mode Actual: The current mode of the block Permitted: Allowed modes for Target Normal: Most common mode for Target
TARGET	5.1	RW	ALL	OOS MAN AUTO	OOS until block is configured, then last valid target	
ACTUAL	5.2	RO	ALL		OOS	
PERMITTED	5.3	RW	ALL	OOS+MAN+AUTO	OOS+MAN+AUTO	
NORMAL	5.4	RO	ALL		AUTO	
Block Error BLOCK_ERR	6	RO	NA	Defined Bits 1: Block Configuration Error 3: Simulate Active 7: Input Failure / Bad PV Status 14: Power-up 15: Out-of-Service	Dynamic	Data Type: Bit String 0=Inactive 1=Active This parameter reflects the error status associated with the hardware or software components associated with a block. Multiple errors may be shown..
Process Value Discrete PV_D	7	RO	NA	PV_D Status set equal to Field_Val_D Status	Dynamic	Data Type: DS-66 The process variable used in block execution. Value is converted from Readback to show the actuator position in the same units as the set point value.
Output Discrete OUT_D	8		OOS MAN	OUT_STATE		Data Type: DS-66 The primary discrete value calculated as a result of executing the function.

-Continued-

Table B-20. Discrete Input Function Block Parameter Definitions (Continued)

Label PARAMETER_NAME	Index Number	RO / RW	Block Mode	Range	Initial Value	Description
Simulate Discrete SIMULATE_D	9					Data Type: DS-83 Allows the transducer discrete input or output to the block to be manually supplied when simulate is enabled. When simulation is disabled, the simulate value and status track the actual value and status.
SIMULATE_STATUS	9.1		ALL		0	
SIMULATE_VALUE	9.2		ALL		0	
TRANSDUCER_STATUS	9.3	RO	ALL		0	
TRANSDUCER_VALUE	9.4	RO	ALL		0	
ENABLE/DISABLE	9.5			0=Not initialized 1=Simulation Disabled 2=Simulation Active	1=Simulation Disabled	
Transducer State XD_STATE	10		ALL		0	Data Type: Uint16 Index to the text describing the states of a discrete for the value obtained from the transducer.
Output State OUT_STATE	11		ALL		0	Data Type: Unsigned16 Index to the text describing the states of a discrete output.
Grant Deny GRANT_DENY	12					Data Type: DS-70 Options for controlling access of host computers and local control panels to operating, tuning, and alarm parameters of the block. GRANT: 0=NA, 1=granted DENY: 0=NA, 1=denied
GRANT	12.1		ALL	0: Program 1: Tune 2: Alarm 3: Local	All bits:0	
DENY	12.2		ALL		All bits: 0	
I/O Options IO_OPTS	13		OOS	0: Invert	All bits:0	Data Type: Bit String 0=Disable 1=Enable Allows you to select how the I/O signals are processed.
Status Options STATUS_OPTS	14		OOS	3=Propagate Failure Forward 8=Uncertain in MAN mode	All bits:0	Data Type: Bit String 0=Disable 1=Enable Options the user may select for the block processing of status.
DI Channel CHANNEL	15		OOS	6: DI_1 7: DI_2	0=Undefined	Data Type: Unsigned16 Defines the functionality of the discrete input. See I/O Selection for details.
Process Value Filter Time PV_FTIME	16		ALL	Positive	0	Data Type: Float Time that FIELD_VAL_D must be in a new state, before the change is reflected to PV_D and OUT_D.
Field Value Discrete FIELD_VAL_D	17	RO			0	Data Type: DS-66 Raw value of the field device discrete input, with a status reflecting the transducer condition.
Update Event UPDATE_EVT	18					Data Type: DS-73 This alert is generated by any change to the static data.
UNACKNOWLEDGED	18.1	RW	NA	0=Undefined 1=Acknowledged 2=Unacknowledged	0=Undefined	
UPDATE_STATE	18.2	RO	NA	0=Undefined 1=Update Reported 2=Updated not reported	0=Undefined	
TIME_STAMP	18.3	RO	NA		0	
STATIC_REVISION	18.4	RO	NA		0	
RELATIVE_INDEX	18.5	RO	NA		0	

-Continued-

Table B-20. Discrete Input Function Block Parameter Definitions (Continued)

Label PARAMETER_NAME	Index Number	RO / RW	Block Mode	Range	Initial Value	Description
Block Alarm BLOCK_ALM	19				Dynamic	Data Type: DS-72 The block alarm is used for all configuration, hardware, connection failure, or system problems in the block. The cause of the alert is entered in the subcode field. The first alert to become active will set the active status in the status parameter. As soon as the unreported status is cleared by the alert reporting procedure, and other block alert may be reported without clearing the active status, if the subcode has changed.
UNACKNOWLEDGED	19.1	RW	NA	0=Undefined 1=Acknowledged 2=Unacknowledged		
ALARM_STATE	19.2	RO	NA	0=Undefined 1=Clear reported 2=Clear not reported 3=Active reported 4=Active not reported		
TIME_STAMP	19.3	RO	NA			
SUBCODE	19.4	RO	NA			
VALUE	19.5	RO				
Alarm Summary ALARM_SUM	20			0: Discrete alarm 7: Block Alarm		Data Type: DS-74 The current alert status, unacknowledged states, unreported states, and disabled states of the alarms associated with the function block. 0=clear reported 0=acknowledged 0=reported 0=enabled
CURRENT	20.1	RO			All bits: 0	
UNACKNOWLEDGED	20.2	RO			All bits: 0	
UNREPORTED	20.3	RO			All bits: 0	
DISABLED	20.4	RW			All bits: 0	
Acknowledge Option ACK_OPTION	21		ALL	0: Discrete 1: Block Alarm	All bits: 0	Data Type: Bit String 0=Disable 1=Enable Used to set auto acknowledgement of alarms
Discrete Priority DISC_PRI	22		ALL	0 to 15	0	Data Type: Unsigned8 Priority of the discrete alarm.
Discrete Limit DISC_LIM	23		ALL	PV_STATE	0	Data Type: Unsigned8 State of discrete input which will generate an alarm.
Discrete Alarm DISC_ALM	24					Data Type: DS-72 The discrete alarm is used for indication of a state change in selected discrete channel.
UNACKNOWLEDGED	24.1	RW	NA	0=Undefined 1=Acknowledged 2=Unacknowledged		
ALARM_STATE	24.2	RO	NA	0=Undefined 1=Clear reported 2=Clear not reported 3=Active reported 4=Active not reported		
TIME_STAMP	24.3	RO	NA			
SUBCODE	24.4	RO	NA			
VALUE	24.5	RO	NA			

View Lists

View lists allow the values of a set of parameters to be accessed at the same time. Views 1 and 2 contain operating parameters and are defined by the Fieldbus Foundation. View 3 contains dynamic parameters and View 4 contains static parameters with configuration and maintenance information. Views 3 and 4 are defined by the manufacturer.

Table B-21. DI Function Block, View 1

Index Number	Parameter
1	ST_REV
5.1	MODE_BLK.TARGET_MODE
5.2	MODE_BLK.ACTUAL_MODE
5.3	MODE_BLK.PERMITTED_MODE
5.4	MODE_BLK.NORMAL_MODE
6	BLOCK_ERR
7	PV_D
8	OUT_D
17	FIELD_VAL_D
20.1	ALARM_SUM.CURRENT
20.2	ALARM_SUM.UNACKNOWLEDGED
20.3	ALARM_SUM.UNREPORTED
20.4	ALARM_SUM.DISABLED

Table B-22. DI Function Block, View 2

Index Number	Parameter
1	ST_REV
10	XD_STATE
11	OUT_STATE
12.1	GRANT_DENY.GRANT
12.2	GRANT_DENY.DENY

Table B-23. DI Function Block, View 3

Index Number	Parameter
1	ST_REV
5.1	MODE_BLK.TARGET_MODE
5.2	MODE_BLK.ACTUAL_MODE
5.3	MODE_BLK.PERMITTED_MODE
5.4	MODE_BLK.NORMAL_MODE
6	BLOCK_ERR
7	PV_D
8	OUT_D
17	FIELD_VAL_D
20.1	ALARM_SUM.CURRENT
20.2	ALARM_SUM.UNACKNOWLEDGED
20.3	ALARM_SUM.UNREPORTED
20.4	ALARM_SUM.DISABLED

Table B-24. DI Function Block, View 4

Index Number	Parameter
1	ST_REV
3	STRATEGY
4	ALERT_KEY
13	IO_OPTS
14	STATUS_OPTS
15	CHANNEL
16	PV_FTIME
21	ACK_OPTION
22	DISC_PRI
23	DISC_LIM

Field Communicator Menu Structure

DISCRETE INPUT FUNCTION BLOCK

Quick Config
- Alert Key
- Process Value Discrete: Status
- Process Value Discrete: Value

Common Config
- Alert Key
- Discrete Limit
- I/O Options
- Block Mode: Target
- Block Mode: Actual
- Block Mode: Permitted
- Block Mode: Normal
- Process Value Filter Time

Advanced Config
- DI Channel
- Output State
- Simulate Discrete: Simulate Status
- Simulate Discrete: Simulate Value
- Simulate Discrete: Transducer Status
- Simulate Discrete: Transducer Value
- Simulate Discrete: Simulate En/Disable
- Static Revision
- Status Options
- Transducer State

Connectors
- Output Discrete: Status
- Output Discrete: Value
- Strategy

Online
- Block Error
- Field Value Discrete: Status
- Field Value Discrete: Value
- Block Mode: Target
- Block Mode: Actual
- Block Mode: Permitted
- Block Mode: Normal
- Output Discrete: Status
- Output Discrete: Value
- Process Value Discrete: Status
- Process Value Discrete: Value

Status
- Block Error

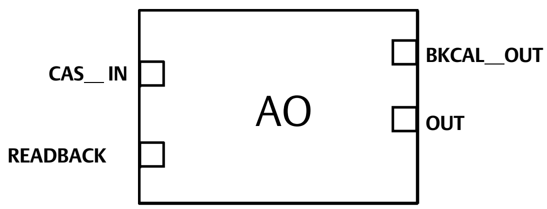
Other
- Tag Description
- Grant Deny: Grant
- Grant Deny: Deny
- Update Event: Unacknowledged
- Update Event: Update State
- Update Event: Time Stamp
- Update Event: Static Rev
- Update Event: Relative Index
- Block Alarm: Unacknowledged
- Block Alarm: Alarm State
- Block Alarm: Time Stamp
- Block Alarm: Subcode
- Block Alarm: Value
- Alarm Summary: Current
- Alarm Summary: Unacknowledged
- Alarm Summary: Unreported
- Alarm Summary: Disabled
- Acknowledge Option
- Discrete Alarm: Unacknowledged
- Discrete Alarm: Alarm State
- Discrete Alarm: Time Stamp
- Discrete Alarm: Subcode
- Discrete Alarm: Discrete Value

All
- Characteristics
- Static Revision
- Tag Description
- Strategy
- Alert Key
- Block Mode: Target
- Block Mode: Actual
- Block Mode: Permitted
- Block Mode: Normal
- Block Error
- Process Value Discrete: Status
- Process Value Discrete: Value
- Output Discrete: Status
- Output Discrete: Value
- Simulate Discrete: Simulate Status
- Simulate Discrete: Simulate Value
- Simulate Discrete: Transducer Status
- Simulate Discrete: Transducer Value
- Simulate Discrete: Simulate En/Disable
- Transducer State
- Output State
- Grant Deny: Grant
- Grant Deny: Deny
- I/O Options
- Status Options
- DI Channel
- Process Value Filter Time
- Field Value Discrete: Status
- Field Value Discrete: Value
- Update Event: Unacknowledged
- Update Event: Update State
- Update Event: Time Stamp
- Update Event: Static Rev
- Update Event: Relative Index
- Block Alarm: Unacknowledged
- Block Alarm: Alarm State
- Block Alarm: Time Stamp
- Block Alarm: Subcode
- Block Alarm: Value
- Alarm Summary: Current
- Alarm Summary: Unacknowledged
- Alarm Summary: Unreported
- Alarm Summary: Disabled
- Acknowledge Option
- Discrete Priority
- Discrete Limit
- Discrete Alarm: Unacknowledged
- Discrete Alarm: Alarm State
- Discrete Alarm: Time Stamp
- Discrete Alarm: Subcode
- Discrete Alarm: Discrete Value

Analog Output (AO) Function Block

The Analog Output (AO) function block (figure B-10) assigns an output value to a field device through a specified I/O channel. The block supports mode control, signal status calculation, and simulation. Figure B-11 illustrates the internal components of the AO function block, and table B-27 lists the definitions of the block parameters.

Figure B-10. Analog Output (AO) Function Block



CAS_IN = The remote setpoint value from another function block.

BKCAL_OUT = The value and status required by the BKCAL_IN input of another block to prevent reset windup and to provide bumpless transfer to closed loop control.

OUT = The block output and status.

READBACK = Compensation value.

B2716-1

Note

The AO block actual mode will not move to Auto unless:

- Resource Block actual mode is Auto, and
- AO SHED_OPT [27] is set to a non-zero value.

Modes

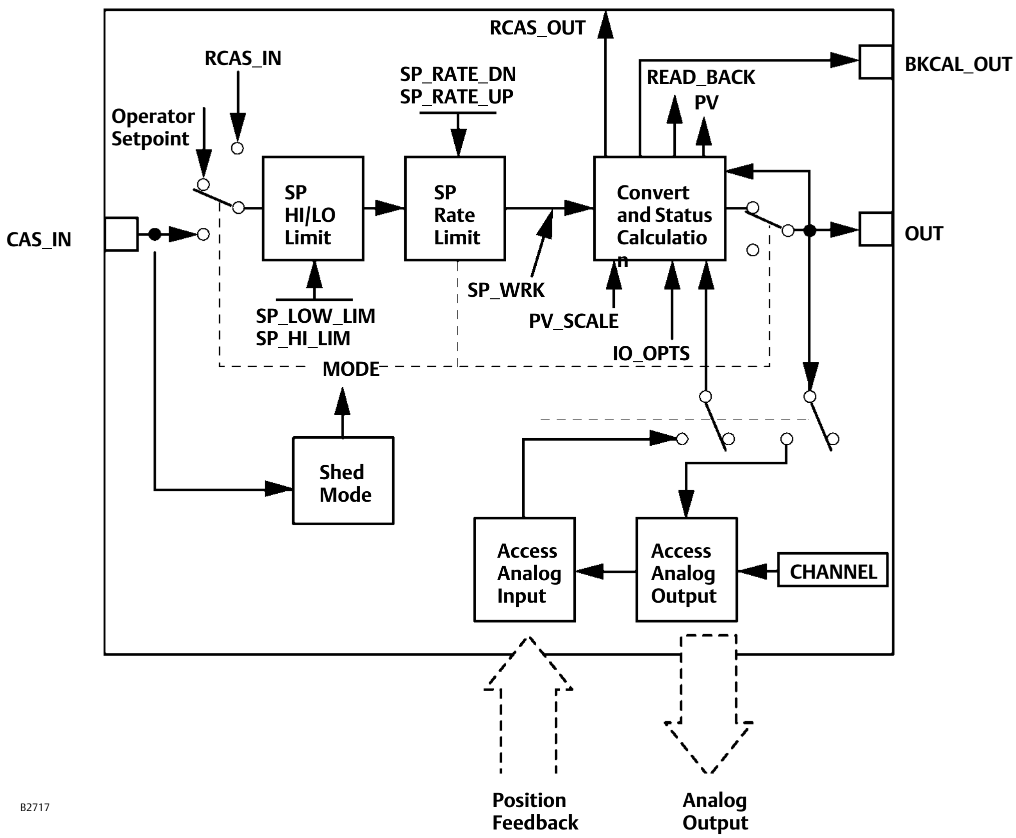
The Analog Output function block supports the following modes:

- Manual (Man)—You can manually set the output to the I/O channel through the OUT [9] attribute. This mode is used primarily for maintenance, calibration and diagnostics.
- Automatic (Auto)—The block output (OUT [9]) reflects the target operating point specified by the setpoint (SP [8]) attribute. Typically the setpoint is set by the user.
- Cascade (Cas)—The SP [8] attribute is set by another function block through a connection to CAS_IN [17]. The SP [8] value is used to set the OUT [9] attribute automatically. This is the most frequently used mode in the digital level controller.

Note

The transducer block must be in Auto for the mode to go to AUTO, CAS, MAN, or RCAS.

Figure B-11. Analog Output Function Block Schematic



- RemoteCascade (RCas)—The SP [8] is set by a host computer by writing to the RCAS_IN [28] parameter. The SP [8] value is used to set the OUT [9] attribute automatically.
- Out of Service (OOS)—The block is not processed. The output channel is maintained at the last value and the status of OUT [9] is set to Bad: Out of Service. The BLOCK_ERR [6] attribute shows Out of Service.
- Initialization Manual (Iman)—The path to the output hardware is broken and the AO block output will remain at the last position. This means the transducer block mode is Out of Service or Manual or configured to respond to the DO block.
- Local Override (LO)—The output of the block is not responding to inputs because the fault state action is active. OUT [9] freezes or goes to value per IO_OPTS [14].

The target mode of the block may be restricted to one or more of the following modes: Man, Auto, Cas, RCas, or OOS.

Mode Handling

Shed Options—RCAS Mode Only

Automatically changing through the permitted modes when starting from a remote mode, fall from (or shed) or climb to a remote mode is determined by the parameter SHED_OPT [27]. A block climbs and sheds through the same path. For example, if SHED_OPT [27] specifies that a block should shed to Auto, then, if the block target mode is set to RCas, the block goes through Auto on the way to RCas.

When the block is in Cas mode and the CAS_IN [17] input goes bad, the block sheds mode to the next lower permitted mode.

You can configure the shed option as follows:

Shed With Return Options

Remote cascade connection failure shifts actual mode but keeps trying to restore remote cascade (in other words, the remote cascade target mode stays in effect).

Note

During Shed with Return Options, the actual mode is changed, while the target mode stays the same.

Normal—On failure of a remote cascade connection the block attempts to attain the highest permitted non-remote mode until remote cascade is restored. Cas is the highest permitted non-remote mode and Auto is is the next permitted non-remote mode. If Cas or Auto are not available, the block will shed by default to Man.

Retained Target—The retained target mode is the previous target mode before it was changed to RCAS or ROUT. On failure of a remote cascade connection the block attempts to attain the retained target mode.

Auto—On failure of a remote cascade connection the block attempts to attain Auto, if permitted, until remote cascade is restored.

Man—On failure of a remote cascade connection the block sheds to Man until a remote cascade connection is restored.

Shed With No Return Options

Note

During Shed with No Return Options, the target mode is changed, while the actual mode stays the same.

For any shed with no return option, the target mode changes as determined by the option. Therefore, there is no attempt to restore the connection following failure. The behavior on change to the remote cascade target mode is identical to that for Shed With Return Options.

Normal—On failure of a remote cascade connection the block sets the target mode to the highest permitted non-remote mode. Cas is the highest permitted non-remote mode and Auto is is the next highest permitted non-remote mode. If Cas or Auto are not available, the block will shed by default to Man.

Retained Target—The retained target mode is the previous target mode before it was changed to RCAS or ROUT. On failure of a remote cascade connection the block sets the target mode to the retained target mode.

Auto—On failure of a remote cascade connection, the block sets the target mode to Auto, if permitted.

Man—On failure of remote cascade connection, the block sets the target mode to Man, if permitted.

The user may configure SHED_OPT [27] so that it calls for a target mode that is not permitted. When doing this, the mode logic uses the following rules as applied by the remote logic:

- Shed logic never results in a non-permitted target mode.
- Shed logic never attempts to attain an actual mode of Auto or Cas if that mode is not permitted.

Status Handling

Output or readback fault detection is reflected in the status of PV [7], OUT [9], and BKCAL_OUT [25]. A limited SP [8] condition is reflected in the BKCAL_OUT [25] status. When simulation is enabled through the SIMULATE [10] attribute, you can set the value and status for PV [7] and READBACK [16].

When the block is in Cas mode and the CAS_IN [17] input goes bad, the block sheds mode to the next permitted mode.

Setting the Output

To set the output for the AO block, you must first set the mode to define the manner in which the block determines its setpoint. In Manual mode the value of the output attribute (OUT [9]) must be set manually by the user, and is independent of the setpoint. In Automatic mode, OUT [9] is set automatically based on the value specified by the set point (SP [8]) in engineering units and the I/O Options attribute. In addition, you can limit the SP [8] value and the rate at which a change in the SP [8] is passed to OUT [9].

In Cascade mode, the cascade input connection (CAS_IN [17]) is used to update the SP [8]. The back calculation output (BKCAL_OUT [25]) is wired to the back calculation input (BKCAL_IN [27]) of the upstream block that provides CAS_IN [17]. This provides bumpless transfer on mode changes and windup protection in the upstream block.

Note

You must wire BKCAL_OUT [25] to BKCAL_IN [27] of the upstream block that provides CAS_IN [17]. Otherwise, the AO will not initialize properly, and the setpoint at CAS_IN [17] will not be passed to OUT [9].

An analog readback value, such as temperature, is shown by the process value (PV [7]) attribute in engineering units.

To support testing, you can enable simulation, which allows you to manually set the channel feedback. There is no alarm detection in the AO function block.

To select the manner of processing the SP and the channel output value configure the setpoint limiting options, the tracking options, and the conversion and status calculations.

FB_OPTIONS

When the resource block parameter FB_OPTIONS [43] is enabled Casin goes directly to the transducer block rather than to OUT. Enable / disable FB_OPTIONS in the resource block. FB_OPTIONS is enabled by default.

FB_OPTIONS, when enabled, alerts you when the device that is providing compensation drops off the segment or goes bad.

Set Point Selection and Limiting

To select the source of the SP [8] value use the MODE [5] attribute. In Automatic (Auto) mode, the local, manually-entered SP [8] is used. In Cascade (Cas) mode, the SP [8] comes from another block through the CAS_IN [17]

input connector. In RemoteCascade (RCas) mode, the SP [8] comes from a host computer that writes to RCAS_IN [28]. The range and units of the SP [8] are defined by the PV_SCALE [11] attribute.

In Manual (Man) mode the SP [8] automatically tracks the PV [7] value when you select the SP-PV Track in Man I/O option in IO_OPTS [14]. You can disable this option in OOS mode only.

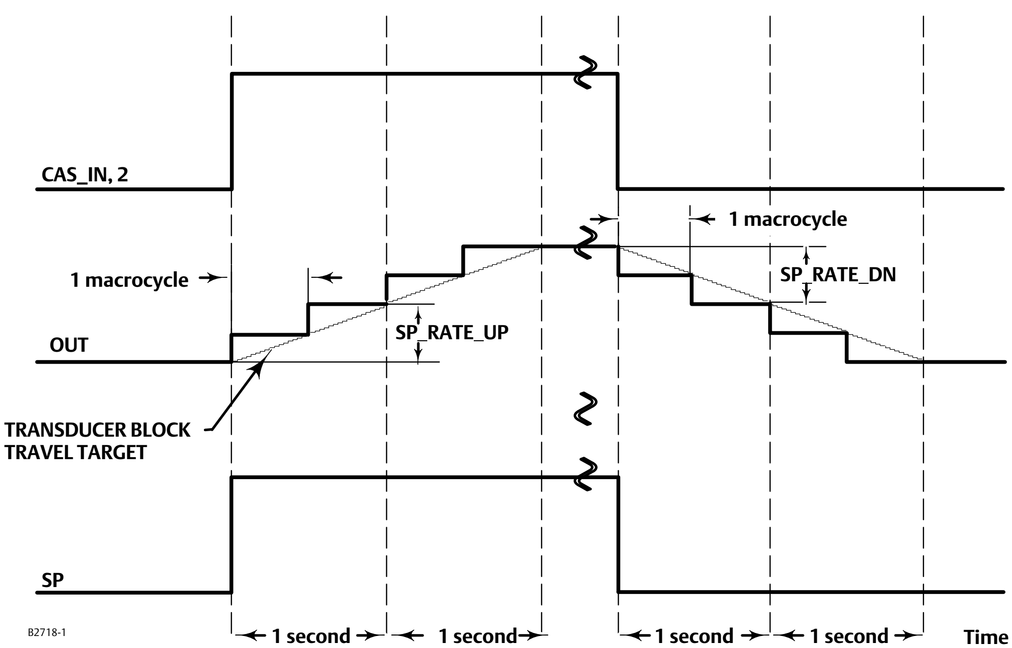
The SP [8] value is limited to the range defined by the setpoint high limit attribute (SP_HI_LIM [20]) and the setpoint low limit attribute (SP_LO_LIM [21]).

In Auto mode, the rate at which a change in the SP [8] is passed to OUT [9] is limited by the values of the setpoint upward rate limit attribute (SP_RATE_UP [19]) and the setpoint downward rate limit attribute (SP_RATE_DN [18]). A limit of zero disables rate limiting.

As shown in figure B-12, the block executes a percentage of the set point change each macrocycle. For example, if the set point rate is set at 10% per second and the macrocycle is 500 milliseconds (0.5 seconds or 50% of 1 second), then during the first macrocycle the set point will change 5% (50% of the 10% per second rate). If the macrocycle is 750 milliseconds (0.75 seconds or 75% of 1 second), then during the first macrocycle the setpoint will change 7.5% (75% of 10).

In Auto mode, the converted SP [8] value is stored in the OUT [9] attribute. In Man mode, the OUT [9] attribute is set manually, and is used to set the analog output defined by the CHANNEL [22] parameter.

Figure B-12. Analog Output Function Block Timing Diagram



Action On Fault Detection

To define the action you wish the compensated value to take when the block is in CAS mode, and the CAS_IN [17] input detects a communication failure, or is commanded to go to fault state by the upstream block or the resource block, configure the following parameters:

IO_OPTS [14]: Determines the action OUT [9] will take upon a fault state. If the IO_OPTS [14] “Fault State to Value” is not selected, then OUT [9] holds its last position when Fault State is set. If “Fault State to Value” is selected, OUT [9] goes to the FSTATE_VAL [24] value when Fault State is set.

FSTATE_TIME [23]: The length of time, in seconds, that the AO block will wait to set Fault State. When Fault State is set, the OUT [9] value goes to either the FSTATE_VAL [24] value or holds its last position, depending on I/O_OPTS [14]. When the block has a target mode of CAS, a fault condition will be detected if the CAS_IN [17] has a BAD status or an Initiate Fault State substatus is received from the upstream block.

FSTATE_VAL [24]: Determines the OUT [9] value if IO_OPTS “Fault State to Value” is selected. The OUT [9] value transitions to FSTATE_VAL [24] after FSTATE_TIME [23] elapses and the fault condition has not cleared.

I/O Options

The I/O options parameter (IO_OPTS [14]) allows you to select how the I/O signals are processed. You can set I/O options in Out of Service mode only. The following I/O options are available in the AO block:

Use PV for BKCAL_OUT—Changes the BKCAL_OUT [25] value to the PV [7] value. When the Use PV for BKCAL_OUT option is not enabled (False), the BKCAL_OUT [25] value is the working setpoint value.

Target to Man if Fault State Activated—Set the target mode to Man, thus losing the original target, if Fault State is activated. This latches an output block into the manual mode.

Use Fault State value on Restart—Use the value of FSTATE_VAL [24] for SP [8] when power is restored or if the device is restarted, otherwise use the last value saved in non-volatile memory. This does not act like Fault State, it only uses the value of FSTATE_VAL [24].

Fault State to Value—The output action to take when a fault occurs (if not selected, use hold last value; if selected, use FSTATE_VAL [24]).

Increase to Close—If the Increase to Close bit is set the value to the transducer is inverted, e.g. 20% becomes 80%.

SP-PV Track in Man—Permits the setpoint to track the process variable when the target mode of the block is MAN.

SP-PV Track in LO or IMan—Permits the setpoint to track the process variable when the actual mode of the block is LO or IMan.

SP Track retained Target—Permits the setpoint to track the RCas or Cas parameter based on the retained target mode when the actual mode of the block is LO or Man. When SP-PV track options are enabled, the SP Track retained target will have precedence in the selection of the value to track when the actual mode is Man and LO.

Simulation

When simulate is active, the transducer sub-parameters show the actual transducer block status and value as normally passed back to the AO block. The Simulate sub-parameters are writable and replace actual transducer values.

Table B-25. Channel Selection for the Analog Output Function Block

Channel	Parameter[1]	Block	Index Number	XD_SCALE Units
2	COMP_TEMPERATURE	TB	31	Celsius (1001), Fahrenheit (1002), Kelvin (1000), Rankine (1003)
3	COMP_PRESSURE	TB	77	Pa (1130), Bar (1137), atm (1140), psig (1143), psia (1142)
4	UPPER_DENSITY	TB	36	kg/m3 (1097), g/cm3 (1100), kg/L (1103), g/mL (1104), g/L (1105), lb/in3 (1106), lb/ft3 (1107), lb/gal (1108), degBaum hv (1111), degBaum lt (1112), degAPI (1113), SGU (1114)
5	LOWER_DENSITY	TB	39	kg/m3 (1097), g/cm3 (1100), kg/L (1103), g/mL (1104), g/L (1105), lb/in3 (1106), lb/ft3 (1107), lb/gal (1108), degBaum hv (1111), degBaum lt (1112), degAPI (1113), SGU (1114)

1. Refer to table B-54 for transducer block parameter description.

Application Information

The configuration of an AO function block and its associated output channels depends on the specific application. A typical configuration for the Analog Output involves the following attributes:

PV_SCALE	Set the range and engineering units to values that correspond to the operation range. For the digital level controller, PV_SCALE [11] is typically set between 0 and 100%.
BKCAL_OUT	If you are using the CAS_IN [17] connector wired from another block, wire the BKCAL_OUT [25] attribute to the other block's BKCAL_IN [27] attribute.
IO_OPTS	Set the type of tracking and action upon fault state.
SHED_OPT	Set the action to be taken when the set point or output are not updated in a remote mode.

Block Errors

Table B-26 lists conditions reported in the BLOCK_ERR [6] parameter. Conditions in *italics* are not applicable for the AO block and are provided only for your reference.

Table B-26. BLOCK_ERR Conditions

Condition Number	Condition Name and Description
0	*Other (NA)*
1	**Block Configuration Error** - CHANNEL and SHED_OPT set to 0
2	*Link Configuration Error (NA)*
3	**Simulate active** - Simulation is enabled and the block is using a simulated value in its execution.
4	**Local Override** - Device in fault state. Actual mode LO.
5	**Device Fault State Set** - AO block in fault state after FSTATE_TIME because of Bad status or IFS substatus on CAS_IN or Resource block commanded fault state.
6	**Device Needs Maintenance Soon** - Indicates a Maintenance PlantWeb Alert condition is active if Block Error Reporting is enabled.
7	*Input failure/process variable has Bad status (NA)*
8	**Output failure** - PV has bad status.
9	*Memory Failure (NA)*
10	*Lost Static Data (NA)*
11	*Lost NV Data (NA)*
12	*Readback Check Failed (NA)*
13	**Device Needs Maintenance Now** - Indicates Failed PlantWeb Alert condition is active if Block Error Reporting is enabled.
14	**Power Up** - This condition exists after power up until actual mode is not Out of Service.
15	**Out of Service** - The block is in Out of Service (OOS) mode.

Analog Output (AO) Function Block

- Read/Write Capability: RO - Read Only, RW - Read Write
- Mode: The block mode(s) required to write to the parameter
- Double indentations and shaded Index Numbers indicate sub-parameters

Table B-27. Analog Output Function Block Parameter Definitions

Label PARAMETER_NAME	Index Number	RO / RW	Block Mode	Range	Initial Value	Description
Static Revision ST_REV	1	RO	NA	0 to 65535	0	Data Type: Unsigned16 The revision level of the static data associated with the function block. The revision value will be incremented each time a static parameter value in the block is changed.
Tag Description TAG_DESC	2	RW	ALL	7 bit ASCII	Spaces	Data Type: Octet String The user description of the intended application of the block.
Strategy STRATEGY	3	RW	ALL	0 to 65535	0	Data Type: Unsigned16 The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.
Alert Key ALERT_KEY	4	RW	ALL	1 to 255	0	Data Type: Unsigned8 The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.
Block Mode MODE_BLK	5					Data Type: DS-69 Valid Bits: 7: OOS, 6: IMAN, 5: LO, 4: MAN, 3: AUTO, 2: CAS, 1: RCAS The actual, target, permitted, and normal modes of the block. Target: The requested block mode Actual: The current mode of the block (Note: Bit 6 (IMAN) is valid for ACTUAL only) Permitted: Allowed modes for Target Normal: Most common mode for Target
TARGET	5.1	RW	ALL	OOS MAN AUTO AUTO-CAS AUTO-RCAS	OOS until block is configured, then last valid target	
ACTUAL	5.2	RO	ALL		OOS	
PERMITTED	5.3	RW	ALL	OOS+MAN+AUTO+ CAS+RCAS	OOS+MAN+A UTO+ CAS+RCAS	
NORMAL	5.4	RW	ALL		AUTO	
Block Error BLOCK_ERR	6	RO	NA	1: Block Configuration Error 3: Simulate Active 4: Local Override 5: Device Fault State Set 8: Output Failure 14: Power-up 15: Out-of-Service	Dynamic	Data Type: Bit String (2 byte) 0=inactive 1=active This parameter reflects the error status associated with the hardware or software components associated with a block. It is a bit string, so that multiple errors may be shown. See table B-26.
Process Variable PV	7	RO	NA	PV Status set equal to READBACK status	Dynamic	Data Type: DS-65 The process variable used in block execution. This value is converted from READBACK to show the compensation value in the same units as the setpoint value.
Set Point SP	8		OOS MAN AUTO	PV_SCALE +/- 10%	Dynamic	Data Type: DS-65 The SP of the analog block. Can be derived from CAS_IN, RCAS_IN in normal modes, or can track PV in MAN, IMan or LO modes. IO_OPTS is used to determine value of SP in MAN, IMan or LO. If no IO_OPTS for SP tracking are set, SP will freeze when mode changes from CAS or RCAS.
Output OUT	9		MAN OOS	OUT_SCALE +/- 10%	Dynamic	Data Type: DS-65 The primary value and status calculated by the block in Auto mode. OUT may be set manually in Man mode.

-Continued-

Table B-27. Analog Output Function Block Parameter Definitions (Continued)

Label PARAMETER_NAME	Index Number	RO / RW	Block Mode	Range	Initial Value	Description
Simulate SIMULATE	10					Data Type: DS-82 Allows the analog input to be manually supplied when simulate is enabled. When simulation is disabled, the simulate value and status track actual value & status.
SIMULATE_STATUS	10.1	RW	ALL		0	
SIMULATE_VALUE	10.2	RW	ALL		0	
TRANSDUCER_STATUS	10.3	RO	ALL		0	
TRANSDUCER_VALUE	10.4	RO	ALL		0	Data Type: DS-82 Allows the analog input to be manually supplied when simulate is enabled. When simulation is disabled, the simulate value and status track actual value & status.
ENABLE/DISABLE	10.5	RW	ALL	0: Not Initialized 1: Simulation Disable 2: Simulation Active	1: Simulation Disabled	
Process Value Scale PV_SCALE	11	RW	OOS	Dependant on Channel selection		Data Type: DS-68 The high and low scale values, engineering units code, and number of decimal places to be used in displaying the PV parameter and parameters which have the same scaling as PV.
Transducer Scale XD_SCALE	12	RO	OOS	Dependant on Channel selection		Data Type: DS-68 The high and low scale values and engineering units code are read only. This parameter determines the number of digits to the right of the decimal point used with the value obtained from the transducer for a specified channel.
Grant Deny GRANT_DENY	13					Data Type: DS-70 Options for controlling access of host computers and local control panels to operating, tuning, and alarm parameters of the block. GRANT: 1 = granted, 0= NA DENY: 1 = denied, 0 = NA
GRANT	13.1	RW	ALL	0: Program 1: Tune 2: Alarm 3: Local	All bits: 0	
DENY	13.2	RW	ALL		All bits: 0	
I/O Options IO_OPTS	14		OOS	1: SP tracks PV in Man 3: SP tracks PV in LO or Iman 4: SP Track retained target in Man or LO 5: Increase to Close 6: Fault State to value 0=freeze 1=go to Fault State value 7: Use Fault State value on restart 8: Target to Man if Fault State activated 9: Use PV for BKCAL_OUT 0=SP 1=PV	All bits: 0	Data Type: Bit String (2 byte) 0=disable 1=enable Allows you to select the type of tracking and the output value when a fault condition occurs.
Status Options STATUS_OPTS	15		OOS	4: Propagate Failure Backward	All bits: 0	Data Type: Bit String 0=disable 1=enable Options the user may select for the block processing of status.
Readback READBACK	16	RO	NA	Status		Data Type: DS-65 Readback is the de-characterized compensation value in use as reported by the transducer block. This correlates with the AO block parameter OUT [9], which is the setpoint to the transducer. READBACK is the simulated input if SIMULATE is enabled or the transducer block feedback if SIMULATE is disabled.
				Value	Dynamic	
Cascade Input CAS_IN	17		ALL	Status	BAD: NC: const	Data Type: DS-65 The setpoint value from another function block.
				Value	0	

-Continued-

Table B-27. Analog Output Function Block Parameter Definitions (Continued)

Label PARAMETER_NAME	Index Number	RO / RW	Block Mode	Range	Initial Value	Description
Setpoint Rate Down SP_RATE_DN	18		ALL	Positive, 0 disables rate limiting PV units	+INF	Data Type: Float Ramp rate for downward set point changes. When the ramp rate is set to zero, the set point is used immediately.
Setpoint Rate Up SP_RATE_UP	19		ALL	Positive, 0 disables rate limiting PV units	+INF	Data Type: Float Ramp rate for upward set point changes. When the ramp rate is set to zero, the setpoint is used immediately.
Setpoint High Limit SP_HI_LIM	20		ALL	PV Scale +/- 10%	100	Data Type: Float The highest set point value allowed. SP_HI_LIM must be greater than SP_LO_LIM.
Setpoint Low Limit SP_LO_LIM	21		ALL	PV Scale +/- 10%	0	Data Type: Float The lowest set point value allowed. SP_LO_LIM must be less than SP_HI_LIM.
AO Channel CHANNEL	22		OOS	2:Temperature 3:Pressure 4:Upper Fluid Density 5:Lower Fluid Density	0	Data Type: Unsigned16 Defines which transducer parameter receives the AO output.
Fault State Time FSTATE_TIME	23		ALL	Positive, seconds	0	Data Type: Float Time from failure detection to reaction if failure still exists.
Fault State Value FSTATE_VAL	24		ALL	PV Scale +/- 10%	0	Data Type: Float Preset value to use if I/O_OPTS Fault State to Value or Use Fault State Value on Restart is set.
Back Calculation Output BKCAL_OUT	25	RO	NA	Status Limits Value	Dynamic	Data Type: DS-65 The value and status required by the BKCAL_IN input of another block to prevent reset windup and to provide bumpless transfer to closed loop control.
Remote Cascade Input RCAS_IN	26		ALL	Status	BAD: NoCom: NoVal: const	Data Type: DS-65 Target SP and status by supervisory host
				Value	0 Trk	
Shed Options SHED_OPT	27		ALL	Defined by FF spec 0=Invalid 1=Normal Shed, Normal Return 2=Normal Shed, No Return 3=Shed to Auto, normal return 4=Shed to Auto, no return. Target mode changes to Auto on detection of a shed condition 5=Shed to Manual, normal return 6=Shed to Manual, No return. Target mode changes to MAN on detection of a shed condition. 7=Shed to retained target, normal return 8=Shed to retained target, no return. (Change target to retained target)	0	Data Type: Unsigned8 Defines the action to be taken when the set point is not updated in a remote mode.
Remote Cascade Output RCAS_OUT	28	RO	NA	Status Value	Dynamic	Data Type: DS-65 Block set point and status after ramping

-Continued-

Table B-27. Analog Output Function Block Parameter Definitions (Continued)

Label PARAMETER_NAME	Index Number	RO / RW	Block Mode	Range	Initial Value	Description
Update Event UPDATE_EVT	29					Data Type: DS-73 This alert is generated by any changes to static data.
UNACKNOWLEDGED	29.1	RW	NA	0:Undefined 1:Acknowledged 2:Unacknowledged	0: Undefined	
UPDATE_STATUS	29.2	RO	NA	0:Undefined 1:Update reported 2:Update not reported	0: Undefined	Data Type: DS-73 This alert is generated by any changes to static data.
TIME_STAMP	29.3	RO	NA		0	
STATIC_REVISION	29.4	RO	NA		0	
RELATIVE_INDEX	29.5	RO	NA		0	
Block Alarm BLOCK_ALM	30					Data Type: DS-72 The block alarm is used for all configuration, hardware, connection failure, or system problems in the block.
UNACKNOWLEDGED	30.1	RW	NA	0:Undefined 1:Acknowledged 2:Unacknowledged	0: Undefined	
ALARM_STATE	30.2	RO	NA	0:Undefined 1:Clear reported 2:Clear not reported 3:Active reported 4:Active not reported	0: Undefined	
TIME_STAMP	30.3	RO	NA		0	
SUBCODE	30.4	RO	NA		0	
VALUE	30.5	RO	NA		0	
Extended Parameters						
StdDev STDDEV	31	RO	NA	positive float	Dynamic	Data Type: Float Standard Deviation.
Cap StdDev CAP_STDDEV	32	RO	NA	positive float	Dynamic	Data Type: Float Capability Standard Deviation.

View Lists

View lists allow the values of a set of parameters to be accessed at the same time. Views 1 and 2 contain operating parameters and are defined by the Fieldbus Foundation. View 3 contains dynamic parameters and View 4 contains static parameters with configuration and maintenance information. Views 3 and 4 are defined by the manufacturer.

Table B-28. AO Function Block, View 1

Index Number	Parameter
1	ST_REV
5.1	MODE_BLK.TARGET_MODE
5.2	MODE_BLK.ACTUAL_MODE
5.3	MODE_BLK.PERMITTED_MODE
5.4	MODE_BLK.NORMAL_MODE
6	BLOCK_ERR
7	PV
8	SP
9	OUT
16	READBACK
17	CAS_IN

Table B-29. AO Function Block, View 2

Index Number	Parameter
1	ST_REV
11	PV_SCALE
12	XD_SCALE
13.1	GRANT_DENY.GRANT
13.2	GRANT_DENY.DENY
20	SP_HI_LIM
21	SP_LO_LIM

Table B-30. AO Function Block, View 3

Index Number	Parameter
1	ST_REV
5.1	MODE_BLK.TARGET_MODE
5.2	MODE_BLK.ACTUAL_MODE
5.3	MODE_BLK.PERMITTED_MODE
5.4	MODE_BLK.NORMAL_MODE
6	BLOCK_ERR
7	PV
8	SP
9	OUT
16	READBACK
17	CAS_IN
25	BKCAL_OUT
26	RCAS_IN
28	RCAS_OUT
31	STDDEV
32	CAP_STDDEV

Table B-31. AO Function Block, View 4

Index Number	Parameter
1	ST_REV
3	STRATEGY
4	ALERT_KEY
14	IO_OPTS
15	STATUS_OPTS
18	SP_RATE_DN
19	SP_RATE_UP
22	CHANNEL
23	FSTATE_TIME
24	FSTATE_VAL
27	SHED_OPT

Field Communicator Menu Structure

ANALOG OUTPUT FUNCTION BLOCK

Quick Config
- Alert Key
- Process Value Scale: EU at 100%
- Process Value Scale: EU at 0%
- Process Value Scale: Units Index
- Process Value Scale: Decimal
- Simulate: Simulate Status
- Simulate: Simulate Value
- Simulate: Transducer Status
- Simulate: Transducer Value
- Simulate: Simulate En/Disable
- Setpoint: Status
- Setpoint: Value
- Setpoint High Limit
- Setpoint Low Limit

Common Config
- Alert Key
- I/O Options
- Block Mode: Target
- Block Mode: Actual
- Block Mode: Permitted
- Block Mode: Normal
- Process Value Scale: EU at 100%
- Process Value Scale: EU at 0%
- Process Value Scale: Units Index
- Process Value Scale: Decimal
- Setpoint: Status
- Setpoint: Value
- Setpoint High Limit
- Setpoint Low Limit

Advanced Config
- Fault State Time
- Fault State Value
- Shed Options
- Simulate: Simulate Status
- Simulate: Simulate Value
- Simulate: Transducer Status
- Simulate: Transducer Value
- Simulate: Simulate En/Disable
- Setpoint Rate Down
- Setpoint Rate Up
- Static Revision
- Status Options
- Strategy
- Transducer Scale: EU at 100%
- Transducer Scale: EU at 0%
- Transducer Scale: Units Index
- Transducer Scale: Decimal

I/O Reference
- AO Channel

Connectors
- Back Calculation Output: Status
- Back Calculation Output: Value
- Cascade Input: Status
- Cascade Input: Value
- Output: Status
- Output: Value

Online
- Back Calculation Output: Status
- Back Calculation Output: Value
- Block Error
- Cascade Input: Status
- Cascade Input: Value
- Block Mode: Target
- Block Mode: Actual
- Block Mode: Permitted
- Block Mode: Normal
- Output: Status
- Output: Value
- Process Value: Status
- Process Value: Value
- Remote Cascade Input: Status
- Remote Cascade Input: Value
- Remote Cascade Output: Status
- Remote Cascade Output: Value
- Readback: Status
- Readback: Value
- Setpoint: Status
- Setpoint: Value

Status
- Block Error

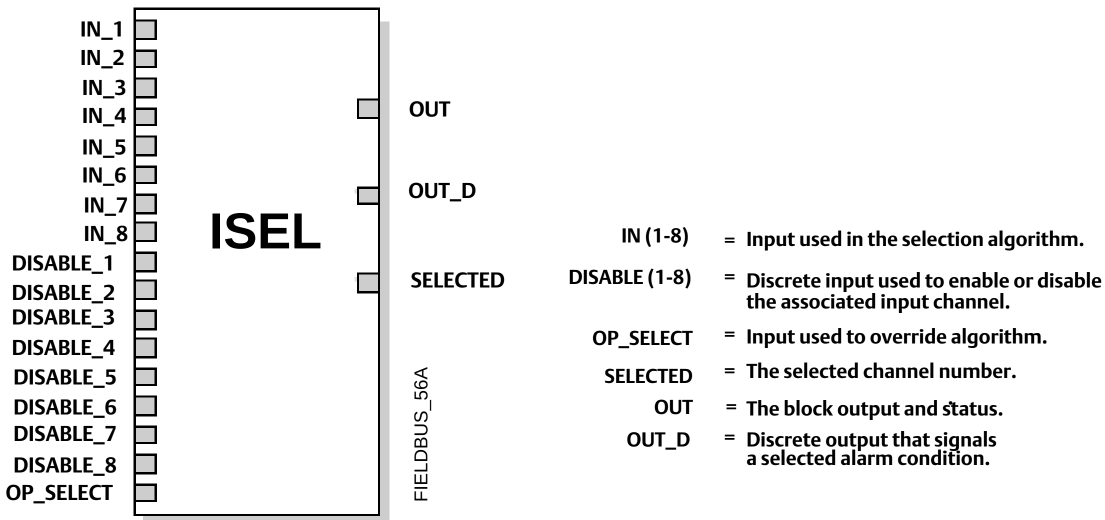
Other
- Tag Description
- Grant Deny: Grant
- Grant Deny: Deny
- Update Event: Unacknowledged
- Update Event: Update State
- Update Event: Time Stamp
- Update Event: Static Rev
- Update Event: Relative Index
- Block Alarm: Unacknowledged
- Block Alarm: Alarm State
- Block Alarm: Time Stamp
- Block Alarm: Subcode
- Block Alarm: Value
- StdDev
- Cap StdDev

All
- Characteristics
- Static Revision
- Tag Description
- Strategy
- Alert Key
- Block Mode: Target
- Block Mode: Actual
- Block Mode: Permitted
- Block Mode: Normal
- Block Error
- Process Value: Status
- Process Value: Value
- Setpoint: Status
- Setpoint: Value
- Output: Status
- Output: Value
- Simulate: Simulate Status
- Simulate: Simulate Value
- Simulate: Transducer Status
- Simulate: Transducer Value
- Simulate: Simulate En/Disable
- Process Value Scale: EU at 100%
- Process Value Scale: EU at 0%
- Process Value Scale: Units Index
- Process Value Scale: Decimal
- Transducer Scale: EU at 100%
- Transducer Scale: EU at 0%
- Transducer Scale: Units Index
- Transducer Scale: Decimal
- Grant Deny: Grant
- Grant Deny: Deny
- I/O Options
- Status Options
- Readback: Status
- Readback: Value
- Cascade Input: Status
- Cascade Input: Value
- Setpoint Rate Down
- Setpoint Rate Up
- Setpoint High Limit
- Setpoint Low Limit
- AO Channel
- Fault State Time
- Fault State Value
- Back Calculation Output: Status
- Back Calculation Output: Value
- Remote Cascade Input: Status
- Remote Cascade Input: Value
- Shed Options
- Remote Cascade Output: Status
- Remote Cascade Output: Value
- Update Event: Unacknowledged
- Update Event: Update State
- Update Event: Time Stamp
- Update Event: Static Rev
- Update Event: Relative Index
- Block Alarm: Unacknowledged
- Block Alarm: Alarm State
- Block Alarm: Time Stamp
- Block Alarm: Subcode
- Block Alarm: Value
- StdDev
- Cap StdDev

Input Selector (ISEL) Function Block

The Input Selector (ISEL) function block (figure B-13) can be used to select the first good, maximum, minimum, average, or hot backup from as many as eight input values and place it at the output. The block supports signal status propagation. There is no process alarm detection in the Input Selector function block. Figure B-14 illustrates the internal components of the ISEL function block. Table B-34 lists the ISEL block parameters, their index numbers, and descriptions.

Figure B-13. Input Selector Function Block



Modes

The ISEL function block supports three modes of operation as defined by the MODE_BLK [5] parameter:

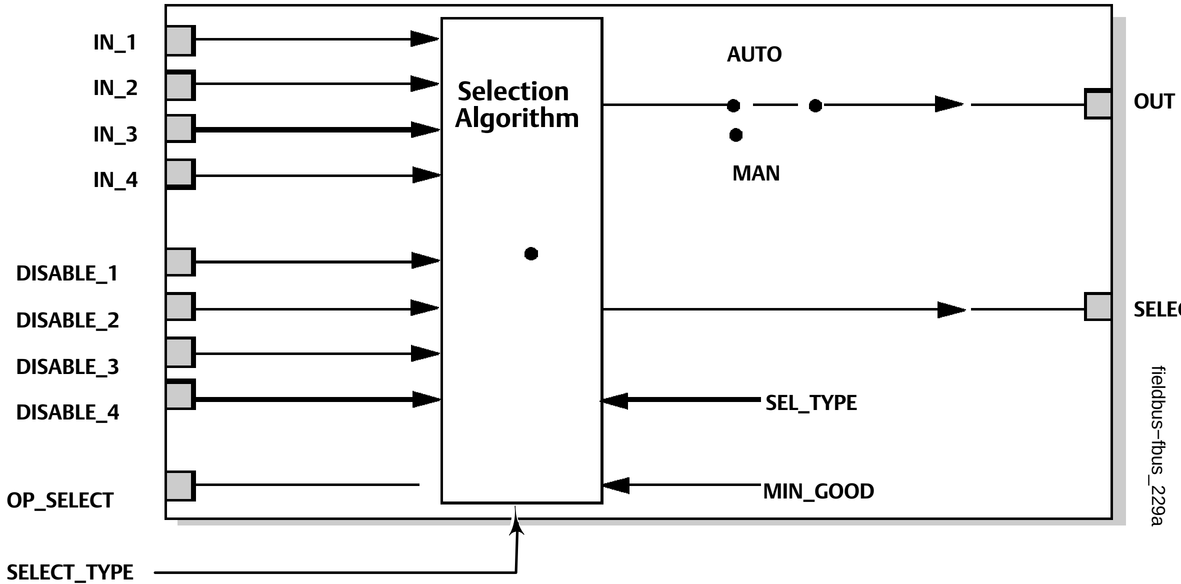
- Manual (Man)—The block output (OUT [7]) may be entered manually.
- Automatic (Auto)—OUT [7] reflects the selected input value.
- Out of Service (OOS)—The block is not processed. The BLOCK_ERR [6] parameter shows Out of Service. In this mode, you can make changes to all configurable parameters. The target mode of a block may be restricted to one or more of the supported modes.

The Input Selector block Actual mode will be Out of Service if any of the following are true:

- The Actual mode of the resource block is not Auto
- The Input Selector block Target mode is Out of Service
- The Input Selector block Target mode is Auto, OP_SELECT [22] is not being used, and SELECT_TYPE [19] is 0. In this case, the BLOCK_ERR [6] parameter shows a Block Configuration Error.

The Input Selector block Actual mode will be Manual if all of the above is not true and the Target mode is Manual.

Figure B-14. Input Selector Function Block Schematic



NOTE: THIS FIGURE DOES NOT INCLUDE THE ADDITIONAL 4 INPUTS IN THE EXTENDED PARAMETERS.

Status Handling

Quality Use and Propagation

In Auto mode, OUT [7] reflects the value and status of the selected input based on the following criteria:

- A bad or disabled input is never used by any of the selection algorithms
- For a selection algorithm to use an input with status of Uncertain, the STATUS_OPTS [10] parameter must have "Use Uncertain as Good."
- STATUS_OPTS [10] is applied before selection.
- If the number of good inputs is less than MIN_GOOD [20], or if the number of inputs evaluated is 0, the status of OUT [7] and SELECTED [21] will be Bad.
- If an input is disabled or its status is Bad and is selected via OP_SELECT [22], then the status of OUT [7] and SELECTED [21] will be Bad. If the quality of the input is Uncertain, and the selection for the STATUS_OPTS [10] parameter is "Use Uncertain as Good," then the status of OUT [7] and SELECTED [21] will be Uncertain. Otherwise the status of OUT [7] and SELECTED [21] will be Good Noncascade.

When the block is in the Manual mode the status and substatus of OUT [7] and SELECTED [21] will be as follows:

- Substatus will be non-specific and the limit will be constant.
- Quality of OUT [7] and SELECTED [21] will be Uncertain if STATUS_OPTS [10] is "Uncertain if in Manual mode." Otherwise, the quality of OUT [7] and SELECTED [21] will be Good Noncascade.

Limit Propagation

Refer to figure B-15. When SELECT_TYPE [19] is Average, Not Limited is propagated unless all inputs have the same limit status. If all inputs have the same limit status, the limit status of the inputs is propagated.

If SELECT_TYPE [19] is Middle and the number of inputs used by the algorithm is greater than one: Not Limited is propagated unless all selected inputs have the same limit status, in which case the limit status of the inputs is propagated.

If SELECT_TYPE [19] is Middle and a single input, or if Maximum or Minimum then: If the selected input is a constant and Middle, Constant is propagated. Otherwise, if the selected input is a constant and Maximum or Minimum, propagate low if Maximum, propagate high if Minimum. If the selected input is not a constant, propagate selected input limit as is.

When SELECT_TYPE [19] is First Good or Hot Spare or if OP_SELECT [22] is non-zero, propagate selected input limit as is.

Substatus Propagation

Refer to figure B-16. For SELECT_TYPE [19] of Maximum, Minimum, First Good, Hot Spare, and Middle with only one input, simply propagate substatus as is.

For SELECT_TYPE [19] of Maximum and Minimum with more than one input with the same value, propagate substatus if all inputs are the same.

For SELECT_TYPE [19] of Average or Middle with more than one input, propagate NonSpecific.

If the status of OUT [7] is Bad, then the substatus will be as follows:

- Out of Service if the Target mode is Out of Service.
- Configuration Error with a BLOCK_ERR [6] of Configuration Error if the Actual mode is Out of Service.
- Otherwise a substatus of Non-Specific.

STATUS_OPTS Supported

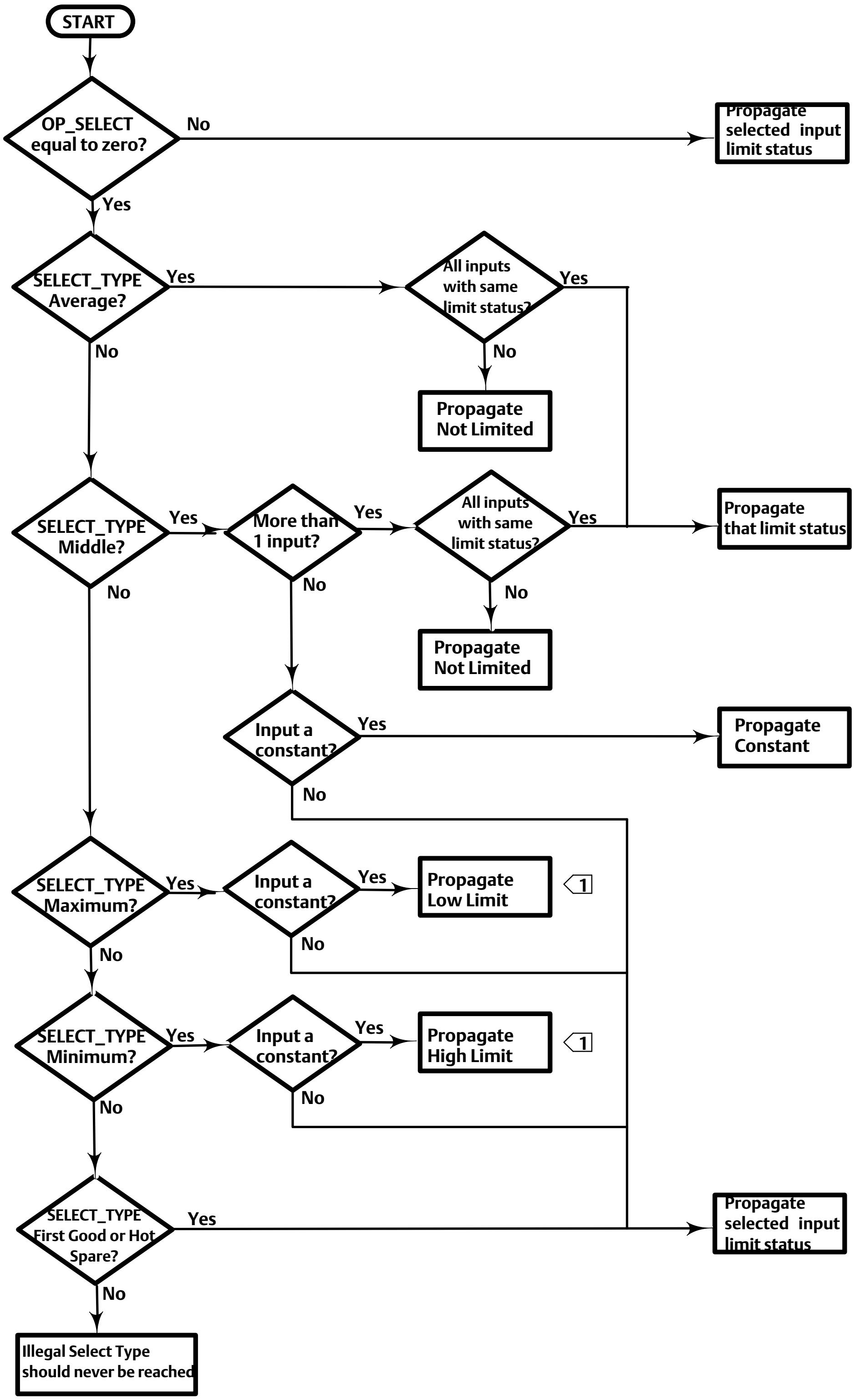
In the STATUS_OPTS [10] parameter, you can select from the following options to control the status handling:

- **Use Uncertain as Good**—sets the OUT [7] status to Good when the selected input status is Uncertain.
- **Uncertain if in Manual mode**: sets the OUT [7] status to Uncertain when the mode is Manual.

Note

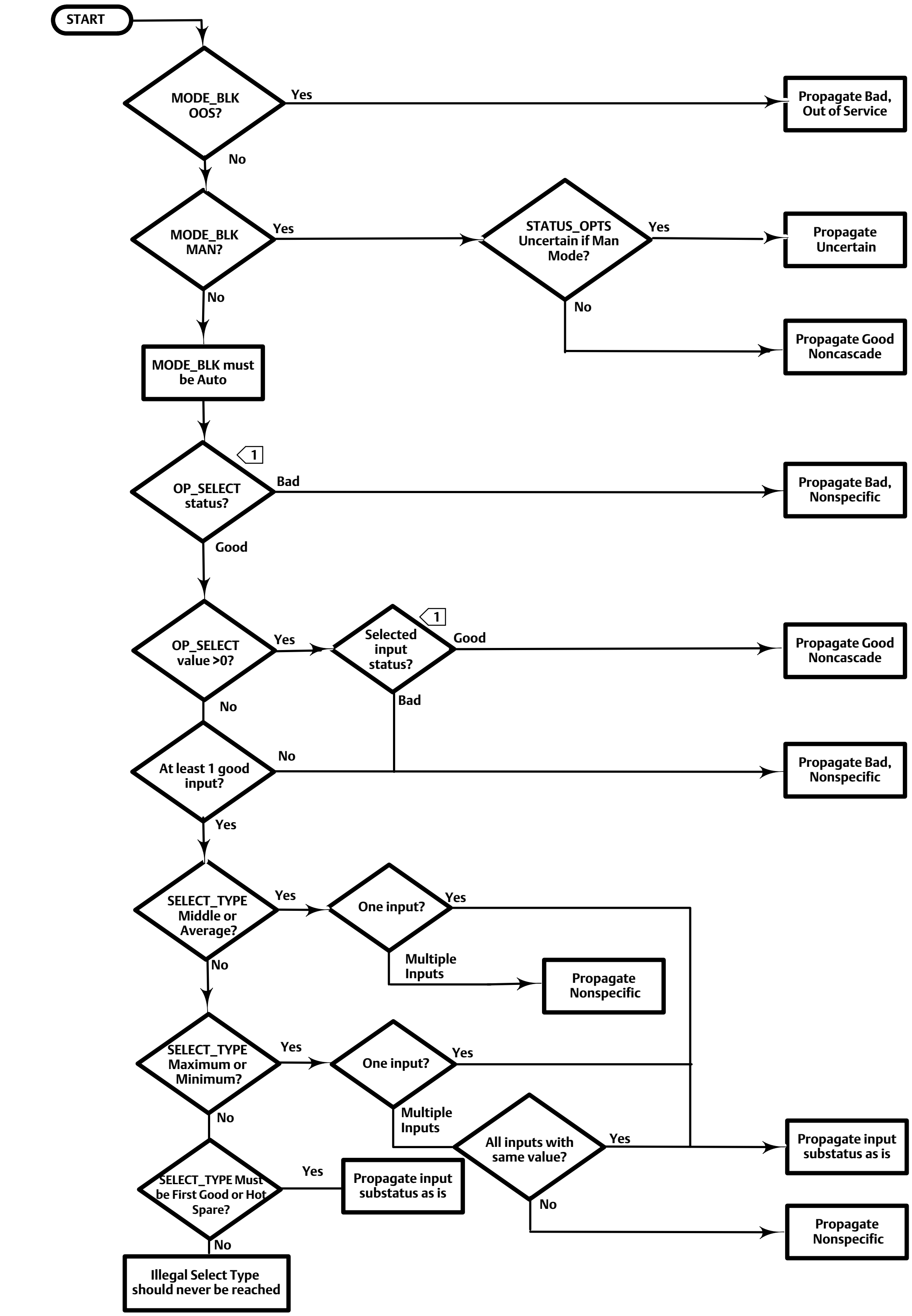
The block mode must be Out of Service to set STATUS_OPTS [10].

Figure B-15. Input Selector Block Limit Propagation



NOTES:
1 LIMIT MANIPULATION FOR A CONSTANT INPUT FOR MAXIMUM AND MINIMUM IS BASED UPON THE FOUNDATION FIELDBUS SPECIFICATION. THE REASONING IS BASED ON HIGH SELECT PROVIDING A LOW LIMIT STATUS AND LOW SELECT PROVIDING A HIGH LIMIT STATUS.

Figure B-16. Input Selector Block Substatus Propagation



NOTES:
1 AN INPUT STATUS MAY BE BAD, GOOD, OR UNCERTAIN. IF BAD, THE INPUT IS NOT USED AND THE STATUS IS PROPAGATED AS BAD WITH SUBSTATUS NON-SPECIFIC. IF GOOD IT IS USED AND THE STATUS IS PROPAGATED AS GOOD (NON-CASCADE). IF UNCERTAIN, AND STATUS_OPTS IS “USE UNCERTAIN AS GOOD” THEN THE INPUT IS USED AND THE STATUS IS PROPAGATED AS GOOD (NON-CASCADE), OTHERWISE IT IS NOT USED AND THE STATUS IS PROPAGATED AS BAD WITH SUBSTATUS NON-SPECIFIC.

Input Selection

The ISEL function block reads the values and statuses of as many as eight inputs (IN_1 [11], IN_2 [12], IN_3 [13], IN_4 [14], IN_5 [25], IN_6 [26], IN_7 [27], IN_8 [28]). To use any of the six selection algorithms to select the output, OP_SELECT [22] must be 0. To specify which algorithm to use, configure the selector type parameter (SELECT_TYPE [19]) as follows:

- Maximum—selects the input with the highest value from the inputs that are not bad and not disabled.
- Minimum—selects the input with the lowest value from the inputs that are not bad and not disabled.
- Average—calculates the average value of the inputs that are not bad and not disabled and provides it as the output. For example, if the number used to average (AVG_USE [33]) is 4 and the number of connected inputs is 6, then the highest and lowest values would be dropped prior to calculating the average. If AVG_USE [33] is 2 and the number of connected inputs is 7, then the two highest and lowest values would be dropped prior to calculating the average and the average would be based on the middle three inputs.
- Middle—If the number of good usable inputs is odd, then it selects the middle value. If the number of good usable inputs is even, then it averages the middle two values and selects status as worst of two. If both inputs' limit status are not the same then it sets limit status of Not Limited.
- First Good—selects the first input that is not bad and not disabled, starting with IN_1 [11].
- Hot Spare—initially uses the input selected as first good. If the selected input goes bad, the first good selection is repeated. If the selected input remains good, it stays selected. If the originally selected input returns to good status the selection does not change. Selection changes only if the currently selected input goes bad.

Disabling Inputs

Use the parameters DISABLE_1 [15], DISABLE_2 [16], DISABLE_3 [17], DISABLE_4 [18], DISABLE_5 [29], DISABLE_6 [30], DISABLE_7 [31] and DISABLE_8 [32] to disable the corresponding inputs. An input that is disabled will not be used by any of the selection algorithms.

The status of the disable parameter must be “Good,” “Good_Cascade,” or “Uncertain” with a STATUS_OPTS [10] of “Use Uncertain as Good” in order to be evaluated. If the status of the disable parameter is Bad, its last usable value is maintained and acted upon. If the device restarts, losing the last usable value, the last usable value is set to disabled. IN_1 through IN_8 and DISABLE_1 through DISABLE_8 are non-volatile type parameters so if they are Linked they will automatically have Bad status until connections are re-established. If they are not Linked, they will be restored with the previous value from NVM across device restarts.

Direct Selection of Inputs

The parameter OP_SELECT [22] can be used to select a particular input. If OP_SELECT [22] is non-zero, the selection algorithm is bypassed and the value of OP_SELECT [22] is interpreted as the input number to select. If the OP_SELECT [22] value is greater than the number of inputs, then the highest input is selected. The status of OP_SELECT [22] must be “Good,” “Good_Cascade,” or “Uncertain” with a STATUS_OPTS [10] of “Use Uncertain as Good” in order to be evaluated. If the status of OP_SELECT [22] is Bad, then the OUT [7] status is Bad.

Identification of Selected Inputs

For a SELECT_TYPE [19] of Maximum, Minimum, Middle, First Good, and Hot Spare, SELECTED [21] indicates the number of the selected input. When Middle is computed from more than one input, SELECTED [21] is set to 0.

For a SELECT_TYPE [19] of Average, SELECTED [21] indicates the number of inputs used in the average calculation.

When the block mode is Manual, SELECTED [21] is set to 0.

Alarm Detection

A block alarm will be generated whenever the BLOCK_ERR [6] has an error bit set. The types of block error for the PID block are defined above.

Process alarm detection is based on OUT [7] value. You can configure the alarm limits of the following standard alarms:

- High (HI_LIM [40])
- High high (HI_HI_LIM [38])
- Low (LO_LIM [42])
- Low low (LO_LO_LIM [44])

In order to avoid alarm chattering when the variable is oscillating around the alarm limit, an alarm hysteresis in percent of the PV span can be set using the ALARM_HYS [36] parameter. The priority of each alarm is set in the following parameters:

- HI_PRI [39]
- HI_HI_PRI [37]
- LO_PRI [41]
- LO_LO_PRI [43]

ACK_OPTION [35] is used to set automatic acknowledgement of alarms.

ALARM_SUM [34] indicates the current alert status, unacknowledged states, and disabled states of the alarms associated with the function block.

Alarms are grouped into five levels of priority, as shown in table B-32.

Table B-32. ISEL Function Block Alarm Priorities

Priority Number	Priority Description[1]
0	The priority of an alarm condition changes to 0 after the condition that caused the alarm is corrected.
1	An alarm condition with a priority of 1 can be recognized by the system. The device monitors the alarm but does not report it until requested by the host system.
2	An alarm condition with a priority of 2 is reported to the operator, but generally does not require operator attention (such as diagnostics and system alerts).
3-7	Alarm conditions of priority 3 to 7 are advisory alarms of increasing priority.
8-15	Alarm conditions of priority 8 to 15 are critical alarms of increasing priority.

1. The priority classes “advise” and critical” have no relationship to Plant Web Alerts.

Block Errors

Table B-33 lists conditions reported in the BLOCK_ERR [6] parameter. Conditions in *italics* are not applicable for the ISEL block and are provided only for your reference.

Table B-33. BLOCK_ERR Conditions

Condition Number	Condition Name and Description
0	*Other (NA)*
1	**Block Configuration Error** - If OP_SELECT is not being used, and SELECT_TYPE = 0. This implies OP_SELECT status is good and actual mode is AUTO.
2	*Link Configuration Error (NA)*
3	*Simulate Active (NA)*
4	*Local Override (NA)*
5	*Device Fault State Set (NA)*
6	*Device Needs Maintenance Soon (NA)*
7	**Input failure/process variable has Bad status** - Set if any IN or any DISABLE or OP_SELECT is bad and connected. This means that a status of BAD NC would not cause an input failure but a status of BAD LUV or BAD no LUV would cause and input failure.
8	Output failure - Set if OUT quality is bad and the Actual mode is not Out of Service.
9	*Memory Failure (NA)*
10	*Lost Static Data (NA)*
11	*Lost NV Data (NA)*
12	*Readback Check Failed (NA)*
13	*Device Needs Maintenance Now (NA)*
14	**Power Up** - Set if the Target mode is Out of Service when powered up until the mode is changed.
15	**Out of Service** - The block is in Out of Service (OOS) mode

Input Selector Block Parameter List

- Read/Write Capability: RO - Read Only, RW - Read Write
- Mode: The block mode(s) required to write to the parameter
- Double indentations and shaded Index Numbers indicate sub-parameters

Table B-34. Input Selector Function Block Parameter Definitions

Label PARAMETER_NAME	Index Number	RO / RW	Block Mode	Range	Initial Value	Description
Static Revision ST_REV	1	RO	NA	0 to 65535	0	Data Type: Unsigned16 The revision level of the static data associated with the function block. The revision value will be incremented each time a static parameter value in the block is changed.
Tag Description TAG_DESC	2	RW	ALL	7 bit ASCII	spaces	Data Type: Octet String The user description of the intended application of the block.
Strategy STRATEGY	3	RW	ALL	0 to 65535	0	Data Type: Unsigned16 The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.
Alert Key ALERT_KEY	4	RW	ALL	1 to 255	0	Data Type: Unsigned8 The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.

-Continued-

Table B-34. Input Selector Function Block Parameter Definitions (Continued)

<table>
<tr><th>Label
PARAMETER_NAME</th><th>Index Number</th><th>RO / RW</th><th>Block Mode</th><th>Range</th><th>Initial Value</th><th>Description</th></tr>
<tr><td>Block Mode
MODE_BLK</td><td>5</td><td colspan="4"></td><td rowspan="5">Data Type: DS-69
Valid Bits: 7: OOS, 4: MAN,
3: AUTO
The actual, target, permitted, and normal modes of the block.
Target: The requested block mode
Actual: The current mode of the block
Permitted: Allowed modes for Target
Normal: Most common mode for Target</td></tr>
<tr><td>TARGET</td><td>5.1</td><td>RW</td><td>ALL</td><td>OOS, MAN, AUTO</td><td>OOS until block is configured, then last valid target</td></tr>
<tr><td>ACTUAL</td><td>5.2</td><td>RO</td><td>ALL</td><td></td><td></td></tr>
<tr><td>PERMITTED</td><td>5.3</td><td>RW</td><td>ALL</td><td>OOS+MAN+AUTO</td><td>OOS+MAN
+AUTO</td></tr>
<tr><td>NORMAL</td><td>5.4</td><td>RW</td><td>ALL</td><td></td><td>AUTO</td></tr>
<tr><td>Block Error
BLOCK_ERR</td><td>6</td><td>RO</td><td>NA</td><td>1: Block Configuration Error
7: Input Failure / Bad PV status
8: Output Failure
14: Power Up
15: Out-of-Service</td><td>Dynamic</td><td>Data Type: Bit String
0=Inactive
1=Active
This parameter reflects the error status associated with the hardware or software components associated with a block. It is a bit string, so that multiple errors may be shown.</td></tr>
<tr><td rowspan="2">Output
OUT</td><td rowspan="2">7</td><td rowspan="2"></td><td rowspan="2">MAN
OOS</td><td>Status
OUT_RANGE</td><td rowspan="2">Dynamic</td><td rowspan="2">Data Type: DS-65
The block output value and status.</td></tr>
<tr><td>Value</td></tr>
<tr><td>Output Range
OUT_RANGE</td><td>8</td><td></td><td>ALL</td><td>EU at 100%
EU at 0%
Units Index
Decimal Point</td><td>100
0
%
2</td><td>Data Type: DS-67
High and low scale values, engineering units code, and number of digits to the right of the decimal point associated with OUT.</td></tr>
<tr><td>Grant Deny
GRANT_DENY</td><td>9</td><td colspan="4"></td><td rowspan="3">Data Type: DS-70
Options for controlling access of host computers and local control panels to operating, tuning, and alarm parameters of the block. Not used by device.
GRANT: 0=NA, 1=granted
DENY: 0=NA, 1=denied</td></tr>
<tr><td>GRANT</td><td>9.1</td><td></td><td>ALL</td><td rowspan="2">0: Program
1: Tune
2: Alarm
3: Local</td><td>All bits: 0</td></tr>
<tr><td>DENY</td><td>9.2</td><td></td><td>ALL</td><td>All bits:0</td></tr>
<tr><td>Status Options
STATUS_OPTS</td><td>10</td><td></td><td>OOS</td><td>2: Use Uncertain as GOOD
8: Uncertain if MAN</td><td>All bits: 0</td><td>Data Type: Bit String
Allows you to select options for status handling and processing. The supported status option for the input selector block is: “Use Uncertain as Good”, “Uncertain if Man mode.”</td></tr>
<tr><td rowspan="2">Input 1
IN_1</td><td rowspan="2">11</td><td rowspan="2"></td><td rowspan="2">ALL</td><td>Status</td><td>BAD
NC
constant</td><td rowspan="2">Data Type: DS-65
The block input value and status.</td></tr>
<tr><td>Value</td><td>0</td></tr>
<tr><td rowspan="2">Input 2
IN_2</td><td rowspan="2">12</td><td rowspan="2"></td><td rowspan="2">ALL</td><td>Status</td><td>BAD
NC
constant</td><td rowspan="2">Data Type: DS-65
The block input value and status.</td></tr>
<tr><td>Value</td><td>0</td></tr>
<tr><td rowspan="2">Input 3
IN_3</td><td rowspan="2">13</td><td rowspan="2"></td><td rowspan="2">ALL</td><td>Status</td><td>BAD
NC
constant</td><td rowspan="2">Data Type: DS-65
The block input value and status.</td></tr>
<tr><td>Value</td><td>0</td></tr>
<tr><td rowspan="2">Input 4
IN_4</td><td rowspan="2">14</td><td rowspan="2"></td><td rowspan="2">ALL</td><td>Status</td><td>BAD
NC
constant</td><td rowspan="2">Data Type: DS-65
The block input value and status.</td></tr>
<tr><td>Value</td><td>0</td></tr>
<tr><td rowspan="2">Disable Analog Input 1
DISABLE_1</td><td rowspan="2">15</td><td rowspan="2"></td><td rowspan="2">ALL</td><td>Status</td><td>BAD
NC
constant</td><td rowspan="2">Data Type: DS-66
Enable/Disable for Input_1, If parameter is TRUE then input is disabled. If parameter status is BAD it is not evaluated.</td></tr>
<tr><td>Value
0=Use
1=Disable</td><td>0</td></tr>
</table>

-Continued-

Table B-34. Input Selector Function Block Parameter Definitions (Continued)

Label PARAMETER_NAME	Index Number	RO / RW	Block Mode	Range	Initial Value	Description
Disable Analog Input 2 DISABLE_2	16		ALL	Status	BAD NC constant	Data Type: DS-66 Enable/Disable for Input_2, If parameter is TRUE then input is disabled. If parameter status is BAD it is not evaluated.
				Value 0=Use 1=Disable	0	
Disable Analog Input 3 DISABLE_3	17		ALL	Status	BAD NC constant	Data Type: DS-66 Enable/Disable for Input_3, If parameter is TRUE then input is disabled. If parameter status is BAD it is not evaluated.
				Value 0=Use 1=Disable	0	
Disable Analog Input 4 DISABLE_4	18		ALL	Status	BAD NC constant	Data Type: DS-66 Enable/Disable for Input_4, If parameter is TRUE then input is disabled. If parameter status is BAD it is not evaluated.
				Value 0=Use 1=Disable	0	
Select Type SELECT_TYPE	19		ALL	1=First Good 2=Minimum 3=Maximum 4=Middle 5=Average 6=Hot Spare	0	Data Type: Unsigned8 Determines the selector action
Min Good MIN_GOOD	20		ALL	1 - 4 0 initial value only	0	Data Type: Unsigned8 The minimum number of inputs which are “good” is less than the value of MIN_GOOD then set the OUT status to “bad”.
Selected SELECTED	21	RO	NA	Status		Data Type: DS-66 The integer indicating the selected input number.
				Value 0 - 8	Dynamic	
Operator Select OP_SELECT	22		ALL	Status	BAD NC constant	Data Type: DS-66 An operator settable parameter to force a given input to be used.
				Value 0 - 8	0	
Update Event UPDATE_EVT	23					Data Type: DS-73 This alert is generated by any change to the static data.
UNACKNOWLEDGED	23.1	RW	NA	0=Undefined 1=Acknowledged 2=Unacknowledged	0	
UPDATE_STATE	23.2	RO	NA	0=Undefined 1=Update Reported 2=Updated not reported	0	
TIME_STAMP	23.3	RO	NA		0	
STATIC_REVISION	23.4	RO	NA		0	
RELATIVE_INDEX	23.5	RO	NA		0	

-Continued-

Table B-34. Input Selector Function Block Parameter Definitions (Continued)

Label PARAMETER_NAME	Index Number	RO / RW	Block Mode	Range	Initial Value	Description
Block Alarm BLOCK_ALM	24					Data Type: DS-72 The block alarm is used for all configuration, hardware, connection failure, or system problems in the block. The cause of the alert is entered in the subcode field. The first alert to become active will set the active status in BLOCK_ERR. As soon as the Unreported status is cleared by the alert reporting task, another block alert may be reported without clearing the Active status, if the subcode has changed.
UNACKNOWLEDGED	24.1	RW	NA	0=Undefined 1=Acknowledged 2=Unacknowledged	0	
ALARM_STATE	24.2	RO	NA	0=Undefined 1=Clear reported 2=Clear not reported 3=Active reported 4=Active not reported	0	
TIME_STAMP	24.3	RO	NA		0	
SUBCODE	24.4	RO	NA		0	
VALUE	24.5	RO	NA		0	
Extended Parameters						
In 5 IN_5	25		ALL	Status	BAD NC constant	Data Type: DS-65 Input value and status.
				Value	0	
In 6 IN_6	26		ALL	Status	BAD NC constant	Data Type: DS-65 Input value and status.
				Value	0	
In 7 IN_7	27		ALL	Status	BAD NC constant	Data Type: DS-65 Input value and status.
				Value		
In 8 IN_8	28		ALL	Status	BAD NC constant	Data Type: DS-65 Input value and status.
				Value	0	
Disable Analog Input 5 DISABLE_5	29		ALL	Status	BAD NC constant	Data Type: DS-66 Enable/Disable for Input_5, If parameter is TRUE then input is disabled. If parameter status is BAD it is not evaluated.
				Value 0=Use 1=Disable	0	
Disable Analog Input 6 DISABLE_6	30		ALL	Status	BAD NC constant 0	Data Type: DS-66 Enable/Disable for Input_6, If parameter is TRUE then input is disabled. If parameter status is BAD it is not evaluated.
				Value 0=Use 1=Disable	0	
Disable Analog Input 7 DISABLE_7	31		ALL	Value	BAD NC constant	Data Type: DS-66 Enable/Disable for Input_7, If parameter is TRUE then input is disabled. If parameter status is BAD it is not evaluated.
				Status 0=Use 1=Disable	0	
Disable Analog Input 8 DISABLE_8	32		ALL	Value	BAD NC constant	Data Type: DS-66 Enable/Disable for Input_8, If parameter is TRUE then input is disabled. If parameter status is BAD it is not evaluated.
				Status 0=Use 1=Disable	0	
Number used to average AVG_USE	33			1 to 8	0	Data Type: Unsigned8 Number used to average the output. The number of min and max dropped is the number of inputs minus AVG_USE.

-Continued-

Table B-34. Input Selector Function Block Parameter Definitions (Continued)

Label PARAMETER_NAME	Index Number	RO / RW	Block Mode	Range	Initial Value	Description
Alarm Summary ALARM_SUM	34					Data Type: DS-74 Current alert status, unacknowledged states, unreported states, and disabled states of the alarms associated with the function block.
CURRENT	34.1	RO	NA	1: Hi Hi 2: Hi 3: Lo Lo 4: Lo		
UNACKNOWLEDGED	34.2	RO	NA			
UNREPORTED	34.3	RO	NA			
DISABLED	34.4	RW	ALL			
Acknowledge Option ACK_OPTION	35		ALL	1: Hi Hi 2: Hi 3: Lo Lo 4: Lo	0	Data Type: Bit String Selection of whether alarms associated with the block will be automatically acknowledged. 0=Disable 1=Enable
Alarm Hysteresis ALARM_HYS	36		ALL	0 to 50%	0.50%	Data Type: Float Hysteresis on alarms
High High Priority HI_HI_PRI	37		ALL	0 TO 15	0	Data Type: Unsigned8 Priority of the alarm
High High Limit HI_HI_LIM	38		ALL		0	Data Type: Float Value of analog input which will generate an alarm
High Priority HI_PRI	39		ALL	0 TO 15	0	Data Type: Unsigned8 Priority of the alarm
High Limit HI_LIM	40		ALL		0	Data Type: Float Value of analog input which will generate an alarm
Low Priority LO_PRI	41		ALL	0 TO 15	0	Data Type: Unsigned8 Priority of the alarm
Low Limit LO_LIM	42		ALL		0	Data Type: Float Value of analog input which will generate an alarm
Low Low Priority LO_LO_PRI	43		ALL	0 TO 15	0	Data Type: Unsigned8 Priority of the alarm
Low Low Limit LO_LO_LIM	44		ALL		0	Data Type: Float Value of analog input which will generate an alarm
High High Alarm HI_HI_ALM	45					Data Type: DS-71 The high high alarm data, which includes a value of the alarm, a timestamp of occurrence, and the state of the alarm.
UNACKNOWLEDGED	45.1	RW	NA	0=Undefined 1=Acknowledged 2=Unacknowledged	0	
ALARM_STATE	45.2	RO	NA	0=Undefined 1=Clear reported 2=Clear not reported 3=Active reported 4=Active not reported	0	
TIME_STAMP	45.3	RO	NA		0	
SUBCODE	45.4	RO	NA		0	
VALUE	45.5	RO	NA		0	
High Alarm HI_ALM	46					Data Type: DS-71 The high alarm data, which includes a value of the alarm, a timestamp of occurrence, and the state of the alarm.
UNACKNOWLEDGED	46.1	RW	NA	0=Undefined 1=Acknowledged 2=Unacknowledged	0	
ALARM_STATE	46.2	RO	NA	0=Undefined 1=Clear reported 2=Clear not reported 3=Active reported 4=Active not reported	0	
TIME_STAMP	46.3	RO	NA		0	
SUBCODE	46.4	RO	NA		0	
VALUE	46.5	RO	NA		0	

-Continued-

Table B-34. Input Selector Function Block Parameter Definitions (Continued)

Label PARAMETER_NAME	Index Number	RO / RW	Block Mode	Range	Initial Value	Description
Low Alarm LO_ALM	47					Data Type: DS-71 The low alarm data, which includes a value of the alarm, a timestamp of occurrence, and the state of the alarm.
UNACKNOWLEDGED	47.1	RW	NA	0=Undefined 1=Acknowledged 2=Unacknowledged	0	
ALARM_STATE	47.2	RO	NA	0=Undefined 1=Clear reported 2=Clear not reported 3=Active reported 4=Active not reported	0	
TIME_STAMP	47.3	RO	NA		0	
SUBCODE	47.4	RO	NA		0	
VALUE	47.5	RO	NA		0	
Low Low Alarm LO_LO_ALM	48					Data Type: DS-71 The low low alarm data, which includes a value of the alarm, a timestamp of occurrence, and the state of the alarm.
UNACKNOWLEDGED	48.1	RW	NA	0=Undefined 1=Acknowledged 2=Unacknowledged	0	
ALARM_STATE	48.2	RO	NA	0=Undefined 1=Clear reported 2=Clear not reported 3=Active reported 4=Active not reported	0	
TIME_STAMP	48.3	RO	NA		0	
SUBCODE	48.4	RO	NA		0	
VALUE	48.5	RO	NA		0	
Output Discrete OUT_D	49		MAN OOS	Status		Data Type: DS-66 Discrete output to indicate a selected alarm value
				Value 0, 1		
Alarm Select ALM_SEL	50		ALL	Status		Data Type: Bit String Used to select the process alarm conditions that will cause the OUT_D parameter to be set.
				1: Hi Hi 2: Hi 3: Lo Lo 4: Lo	All bits:0	

View Lists

View lists allow the values of a set of parameters to be accessed at the same time. Views 1 and 2 contain operating parameters and are defined by the Fieldbus Foundation. View 3 contains dynamic parameters and View 4 contains static parameters with configuration and maintenance information. Views 3 and 4 are defined by the manufacturer.

Table B-35. ISEL Function Block, View 1

Index Number	Parameter
1	ST_REV
5.1	MODE_BLK.TARGET_MODE
5.2	MODE_BLK.ACTUAL_MODE
5.3	MODE_BLK.PERMITTED_MODE
5.4	MODE_BLK.NORMAL_MODE
6	BLOCK_ERR
7	OUT
11	IN_1
12	IN_2
13	IN_3
14	IN_4
15	DISABLE_1
16	DISABLE_2
17	DISABLE_3
18	DISABLE_4
21	SELECTED
22	OP_SELECT
25	IN_5
26	IN_6
27	IN_7
28	IN_8
29	DISABLE_5
30	DISABLE_6
31	DISABLE_7
32	DISABLE_8
34.1	ALARM_SUM.CURRENT
34.2	ALARM_SUM.UNACKNOWLEDGED
34.3	ALARM_SUM.UNREPORTED
34.4	ALARM_SUM.DISABLED

Table B-36. ISEL Function Block, View 2

Index Number	Parameter
1	ST_REV
8	OUT_RANGE
9.1	GRANT_DENY.GRANT
9.2	GRANT_DENY.DENY

Table B-37. ISEL Function Block, View 3

Index Number	Parameter
1	ST_REV
5.1	MODE_BLK.TARGET_MODE
5.2	MODE_BLK.ACTUAL_MODE
5.3	MODE_BLK.PERMITTED_MODE
5.4	MODE_BLK.NORMAL_MODE

-continued-

Table B-37. ISEL Function Block, View 3 (Continued)

Index Number	Parameter
6	BLOCK_ERR
7	OUT
11	IN_1
12	IN_2
13	IN_3
14	IN_4
15	DISABLE_1
16	DISABLE_2
17	DISABLE_3
18	DISABLE_4
21	SELECTED
22	OP_SELECT
25	IN_5
26	IN_6
27	IN_7
28	IN_8
29	DISABLE_5
30	DISABLE_6
31	DISABLE_7
32	DISABLE_8
34.1	ALARM_SUM.CURRENT
34.2	ALARM_SUM.UNACKNOWLEDGED
34.3	ALARM_SUM.UNREPORTED
34.4	ALARM_SUM.DISABLED
49	OUT_D

Table B-38. ISEL Function Block, View 4

Index Number	Parameter
1	ST_REV
3	STRATEGY
4	ALERT_KEY
10	STATUS_OPTS
19	SELECT_TYPE
20	MIN_GOOD
33	AVG_USE
35	ACK_OPTION
36	ALARM_HYS
37	HI_HI_PRI
38	HI_HI_LIM
39	HI_PRI
40	HI_LIM
41	LO_PRI
42	LO_LIM
43	LO_LO_PRI
44	LO_LO_LIM
50	ALM_SEL

Field Communicator Menu Structure

INPUT SELECTOR FUNCTION BLOCK

Quick Config
- Alert Key
- Min Good
- Output Range: EU at 100%
- Output Range: EU at 0%
- Output Range: Units Index
- Output Range: Decimal
- Select Type

Common Config
- Min Good
- Block Mode: Target
- Block Mode: Actual
- Block Mode: Permitted
- Block Mode: Normal
- Output Range: EU at 100%
- Output Range: EU at 0%
- Output Range: Units Index
- Output Range: Decimal
- Select Type

Advanced Config
- Alert Key
- Static Revision
- Status Options
- Strategy

Connectors
- Disable Analog Input 1: Status
- Disable Analog Input 1: Value
- Disable Analog Input 2: Status
- Disable Analog Input 2: Value
- Disable Analog Input 3: Status
- Disable Analog Input 3: Value
- Disable Analog Input 4: Status
- Disable Analog Input 4 : Value
- Input 1: Status
- Input 1: Value
- Input 2: Status
- Input 2: Value
- Input 3: Status
- Input 3: Value
- Input 4: Status
- Input 4: Value
- Operator Select: Status
- Operator Select: Value
- Output: Status
- Output: Value
- Selected: Status
- Selected: Value

Online
- Block Error
- Disable Analog Input 1: Status
- Disable Analog Input 1: Value
- Disable Analog Input 2: Status
- Disable Analog Input 2: Value
- Disable Analog Input 3: Status
- Disable Analog Input 3: Value
- Disable Analog Input 4: Status
- Disable Analog Input 4: Value
- Input 1: Status
- Input 1: Value
- Input 2: Status
- Input 2: Value
- Input 3: Status
- Input 3: Value
- Input 4: Status
- Input 4: Value
- Block Mode: Target
- Block Mode: Actual
- Block Mode: Permitted
- Block Mode: Normal
- Operator Selected: Status
- Operator Selected: Value
- Output: Status
- Output: Value
- Selected: Status
- Selected: Value

Status
- Block Error

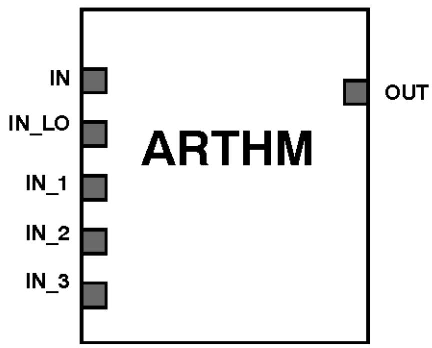
All
- Characteristics
- Static Revision
- Tag Description
- Strategy
- Alert Key
- Block Mode: Target
- Block Mode: Actual
- Block Mode: Permitted
- Block Mode: Normal
- Block Error
- Output: Status
- Output: Value
- Output Range: EU at 100%
- Output Range: EU at 0%
- Output Range: Units Index
- Output Range: Decimal
- Grant Deny: Grant
- Grant Deny: Deny
- Status Options
- Input 1: Status
- Input 1: Value
- Input 2: Status
- Input 2: Value
- Input 3: Status
- Input 3: Value
- Input 4: Status
- Input 4: Value
- Disable Analog Input 1: Status
- Disable Analog Input 1: Value
- Disable Analog Input 2: Status
- Disable Analog Input 2: Value
- Disable Analog Input 3: Status
- Disable Analog Input 3: Value
- Disable Analog Input 4: Status
- Disable Analog Input 4: Value
- Select Type
- Min Good
- Selected: Status
- Selected: Value
- Operator Select: Status
- Operator Select: Value
- Update Event: Unacknowledged
- Update Event: Update State
- Update Event: Time Stamp
- Update Event: Static Rev
- Update Event: Relative Index
- Block Alarm: Unacknowledged
- Block Alarm: Alarm State
- Block Alarm: Time Stamp
- Block Alarm: Subcode
- Block Alarm: Value
- Analog Input 5: Status
- Analog Input 5: Value
- Analog Input 6: Status
- Analog Input 6: Value
- Analog Input 7: Status
- Analog Input 7: Value
- Analog Input 8: Status
- Analog Input 8: Value
- Disable Analog Input 5: Status
- Disable Analog Input 5: Value
- Disable Analog Input 6: Status
- Disable Analog Input 6: Value
- Disable Analog Input 7: Status
- Disable Analog Input 7: Value
- Disable Analog Input 8: Status
- Disable Analog Input 8: Value
- Number Used to average

All (continued)
- Alarm Summary: Current
- Alarm Summary: Unacknowledged
- Alarm Summary: Unreported
- Alarm Summary: Disabled
- Acknowledge Option
- Alarm Hysteresis
- High High Priority
- High High Limit
- High Priority
- High Limit
- Low Priority
- Low Limit
- Low Low Priority
- Low Low Limit
- High High Alarm: Unacknowledged
- High High Alarm: Alarm State
- High High Alarm: Time Stamp
- High High Alarm: Subcode
- High High Alarm: Float Value
- High Alarm: Unacknowledged
- High Alarm: Alarm State
- High High Alarm: Time Stamp
- High Alarm: Subcode
- High Alarm: Float Value
- Low Alarm: Unacknowledged
- Low Alarm: Alarm State
- Low Alarm: Time Stamp
- Low Alarm: Subcode
- Low Alarm: Float Value
- Low Low Alarm: Unacknowledged
- Low Low Alarm: Alarm State
- Low Low Alarm: Time Stamp
- Low Low Alarm: Subcode
- Low Low Alarm: Float Value
- Alarm Output: Status
- Alarm Output: Value
- Alarm Select

Arithmetic (ARTH) Function Block

The Arithmetic function block (figure B-17) provides the ability to configure a range extension function for a primary input and applies the nine (9) different arithmetic types as compensation to or augmentation of the range extended input. All operations are selected by parameter and input connection.

Figure B-17. Arithmetic (ARTH) Function Block



The nine (9) arithmetic functions are Flow Compensation Linear, Flow Compensation Square Root, Flow Compensation Approximate, BTU Flow, Traditional Multiply and Divide, Average, Summer, Fourth Order Polynomial, and Simple HTG Compensate Level.

This Arithmetic function block supports mode control (Auto, Manual, Out of Service). There is no standard alarm detection in this block.

Supported Modes

- Manual (Man)—The block output (OUT) may be set manually
- Automatic (Auto)—OUT reflects the analog input measurement or the simulated value when simulation is enabled.
- Out of Service (OOS)— The block is not processed. FIELD_VAL and PV are not updated and the OUT status is set to Bad: Out of Service. The BLOCK_ERR parameter shows Out of Service. In this mode, you can make changes to all configurable parameters. The target mode of a block may be restricted to one or more of the supported modes. The target mode of a block bay be restricted to one or more of the supported modes.

Alarm Detection

A block alarm will be generated whenever the BLOCK_ERR has an error bit set.

Alarms are grouped into five levels of priority, as shown in table B-39.

Table B-39. ARTH Function Block Alarm Priorities

Priority Number	Priority Description[1]
0	The priority of an alarm condition changes to 0 after the condition that caused the alarm is corrected.
1	An alarm condition with a priority of 1 can be recognized by the system. The device monitors the alarm but does not report it until requested by the host system.
2	An alarm condition with a priority of 2 is reported to the operator, but generally does not require operator attention (such as diagnostics and system alerts).
3-7	Alarm conditions of priority 3 to 7 are advisory alarms of increasing priority.
8-15	Alarm conditions of priority 8 to 15 are critical alarms of increasing priority.

1. The priority classes “advise” and critical” have no relationship to Plant Web Alerts.

Block Execution

The Arithmetic function block provides range extension and compensation through nine (9) arithmetic types.

There are two inputs (IN and IN_LO) used in calculating PV. PV is then combined with up to three inputs (IN_1, IN_2, and IN_3) through the user selected compensation function (ARITH_TYPE) to calculate the value of func. A gain is applied to func and then a bias is added to get the value PRE_OUT. In AUTO, PRE_OUT is used for OUT.

Range Extension and Calculation of PV

When both IN and IN_LO are usable, the following formula is applied to calculate range extension for PV:

PV = G • IN + (1 – G) • IN_LO

G has a range from 0 to 1, for IN from RANGE_LO to RANGE_HI.

Compensation Input Calculations

For each of the inputs IN_1, IN_3, IN_4 there is a gain and bias. The compensation terms (t) are calculated as follows:

- When IN_(k) is usable:

t(k) = GAIN_IN(k) • (BIAS_IN(k) + IN_(k))

- When IN_(k) is not usable, then t(k) gets the value of the last t(k) computed with a usable input.

Status Handling

IN_x Use Bad

IN_x Use Uncertain

IN_LO Use Uncertain

IN Use Uncertain

For complete descriptions of supported input options, refer to the Option Bitstring Parameters topic.

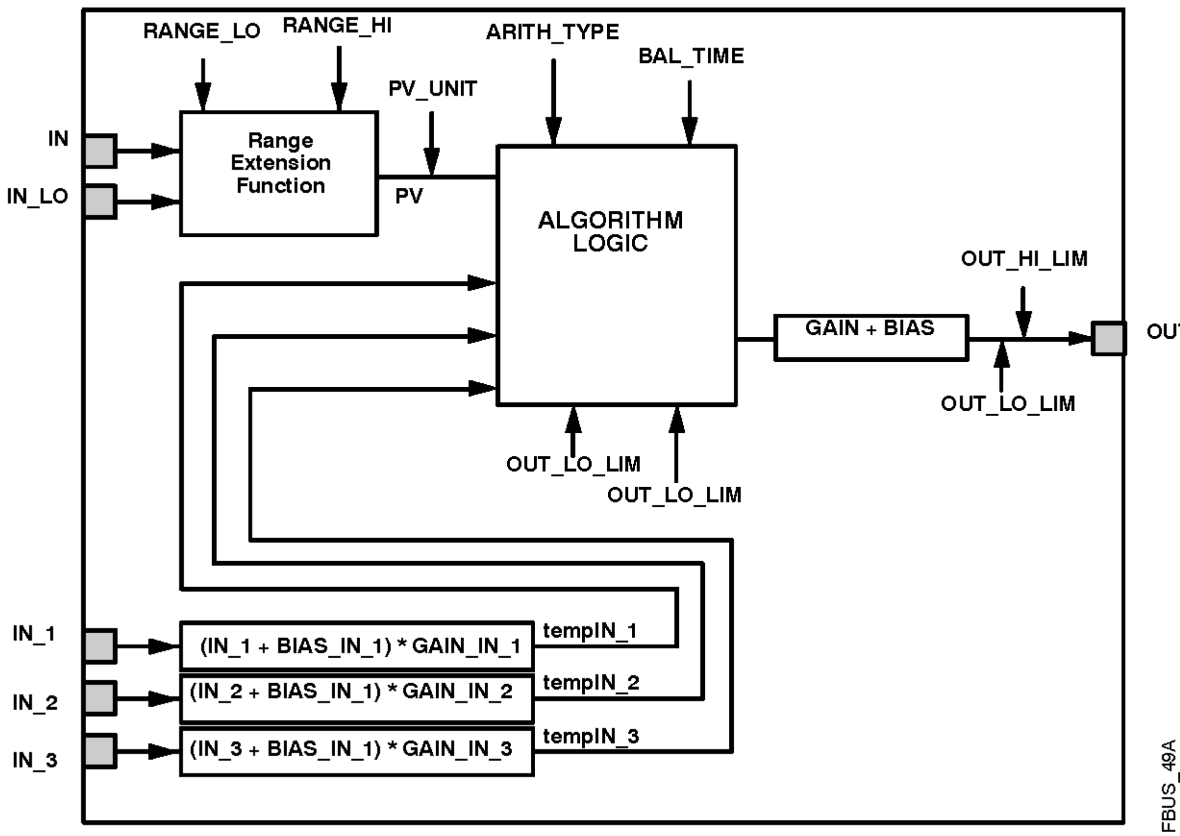
Application Information

The Arithmetic function block can be used to calculate tank level changes based on greatly changing temperature conditions in devices that depend on the physical properties of the fluid.

For example, a differential pressure cell's analog input can be scaled initially to provide a 4-20 mA signal for 0-100% of level indication. As the temperature of the system rises, the density of the fluid decreases. For a system that requires accurate level indication at widely ranging temperature, changing density can be inconvenient.

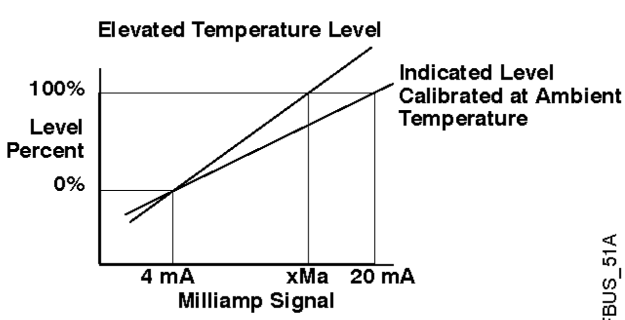
The Arithmetic function block allows for the automatic compensation of this change by incorporating gain and bias adjustments to the temperature signal. It then applies both the compensated temperature signal and the level signal to a characteristic system equation. The result is a level that is a true indication of fluid in the vessel.

Figure B-18. Arithmetic Function Block Schematic



Different fluids over the same temperature range have different effects on level due to their thermal expansion coefficients. Vessel geometry also plays a major role. As the height of the vessel increases, the effect of thermal expansion becomes more apparent. Figure B-19 shows the relative temperature effects on a level signal.

Figure B-19. Relative Temperature Effects on Level

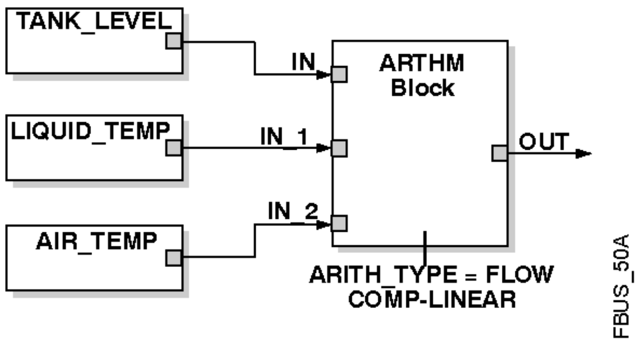


The calculation is done by applying the level signal to the IN connector, the liquid temperature to the IN_1 connector, and the ambient air temperature to the IN_2 connector. Select the Arithmetic type (ARITH_TYPE) of Flow

Compensation - Linear. This allows a ratio to be set up that increases the level indication at block output for an increase in the tank temperature relative to ambient temperature.

This application can be applied to very large storage tanks whose contents are subject to thermal expansion and contraction during seasonal changes in temperature.

Figure B-20. Arithmetic Function Block Diagram Example



Advanced Topics

The parameter, ARITH_TYPE, determines how PV and the compensation terms (t) are combined. You may select from nine (9) commonly used math functions, shown below. COMP_HI and COMP_LO are compensation limits.

Flow Compensation Linear	Flow Compensation Square Root
func = PV • f COMP_HI $f = \frac{t(1)}{t(2)}$ COMP_LO	func = PV • f COMP_HI $f = \sqrt{\frac{t(1) \bullet t(3)}{t(2)}}$ COMP_LO

If there is a divide by zero and the numerator is positive, f is set to COMP_HI; if the numerator is negative, then f is set to COMP_LO. The square root of a negative value will equal the negative of the square root of the absolute value. Imaginary roots are not supported.

Flow Compensation Approximate	BTU Flow	Traditional Multiply and Divide
func = PV • f COMP_HI $f = t(1) \bullet t(2) \bullet t(3)^2$ COMP_LO	f = PV • f COMP_HI $f = t(1) - t(2)$ COMP_LO	f = PV • f COMP_HI $f = \frac{t(1)}{t(2)} + t(3)$ COMP_LO

If there is a divide by zero and numerator is positive, f will be limited to COMP_HI; if the numerator is negative, f will be limited to COMP_LO.

Compensation inputs which are not usable are not included in the calculation. PV is always included.

Average

$$SUM = PV.VAL;n = 1$$

$$Fork = 1, 3\{sum = sum + t(k);n = (n+1)\}EndFor$$

$$func = \frac{sum}{n}$$

Summer

$$SUM = PV$$

$$Fork = 1, 3\{sum = sum + t(k);n = (n+1)\}EndFor$$

$$func = sum$$

Compensation inputs which are not configured are not used in the calculation. PV is always used.

Forth Order Polynomial

$$func = PV + t(1)^2 + t(2)^3 + t(3)^4$$

Simple HTG Compensate Level

$$func = \frac{PV - t(1)}{PV - t(2)}$$

If there is a divide by zero and the numerator is positive, func will be limited to COMP_HI; if the numerator is negative, func will be limited to COMP_LO.

Block Errors

Table B-40 lists conditions reported in the BLOCK_ERR [6] parameter. Conditions in *italics* are inactive for the ARTH block and are given here only for your reference.

Table B-40. BLOCK_ERR Conditions

Condition Number	Condition Name and Description
0	**Other** - the output has a quality of uncertain.
1	**Block Configuration Error** - the selected channel carries a measurement that is incompatible with the engineering units selected in XD_SCALE, the L_TYPE parameter is not configured, or CHANNEL = zero.
2	*Link Configuration Error*
3	*Simulate Active*
4	*Local Override*
5	*Device Fault State*
6	*Device Needs Maintenance Soon*
7	**Input failure/process variable had Bad status** - The hardware is bad, or a bad status is being simulated
8	*Output failure*
9	*Memory failure*
10	*Lost Static Data*
11	*Lost NV Data*
12	*Readback Check Failed*
13	*Device Needs Maintenance Now*
14	**Power Up** - This condition exists until the AI function block executes for the first time.
15	**Out of Service** - The actual mode is Out of Service.

Troubleshooting

Refer to table B-41 to troubleshoot any problems that you encounter.

Table B-41. Troubleshooting

Symptom	Possible Causes	Corrective Action
Mode will not leave OOS	Target mode is not set	Set target mode to something other than OOS
	Configuration error	BLOCK_ERR [6] will show the configuration error set. ARITH_TYPE must be set to a valid value and cannot be left at 0.
	Resource block	The actual mode of the Resource block is OOS. See Resource Block Diagnostics for corrective action.
	Schedule	Block is not scheduled and therefore cannot execute to go to the target mode. Typically, BLOCK_ERR will show “Power-Up” for all blocks that are not scheduled. Schedule the block to execute.
Status of outputs is BAD	Inputs	Input has BAD status.
Block Alarms will not work	Features	FEATURES_SEL does not have Alerts enabled. Enable the Alert bit.
	Notification	• LIM_NOTIFY is not high enough. Set equal to MAX_NOTIFY.
	Status Options	STATUS_OPTS has the Propagate Fault Forward bit set. This must be cleared to cause the alarm to occur.

Arithmetic Function Block Parameter List

- Read/Write Capability: RO - Read Only, RW - Read Write
- Mode: The block mode(s) required to write to the parameter
- Double indentation and shaded Index Number indicates sub-parameter

Table B-42. Arithmetic Function Block Parameter Definitions

Label PARAMETER_NAME	Index Number	RO / RW	Block Mode	Range	Initial Value	Description
Static Revision ST_REV	1	RO	NA	0 to 65535	0	Data Type: Unsigned16 The revision level of the static data associated with the function block. The revision value will be incremented each time a static parameter value in the block is changed.
Tag Description TAG_DESC	2	RW	ALL	7 bit ASCII	Spaces	Data Type: Octet String The user description of the intended application of the block.
Strategy STRATEGY	3	RW	ALL	0 to 65535	0	Data Type: Unsigned16 The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.
Alert Key ALERT_KEY	4	RW	ALL	1 to 255	0	Data Type: Unsigned8 The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.
Block Mode MODE_BLK	5					Data Type: DS-69 Valid Bits: 7:OOS, 4:MAN, 3:AUTO The actual, target, permitted, and normal modes of the block. Target: The requested block mode Actual: The current mode of the block Permitted: Allowed modes for Target Normal: Most common mode for Target
TARGET	5.1	RW	ALL	OOS MAN AUTO	OOS until block is configured, then last valid target	
ACTUAL	5.2	RO	ALL		OOS	
PERMITTED	5.3	RW	ALL	OOS+MAN+AUTO	OOS+MAN+AUTO	
NORMAL	5.4	RO	ALL		AUTO	
Block Error BLOCK_ERR	6	RO	NA	Defined Bits 1: Block Configuration Error 3: Simulate Active 7: Input Failure / Bad PV Status 14: Power-up 15: Out-of-Service	Dynamic	Data Type: Bit String 0=Inactive 1=Active The summary of all configuration or system errors associated with the block.
Process Value PV	7	RO	NA			The process variable used in block execution and alarm limit execution.
Output OUT	8		OOS MAN			The analog output value and status. The number of outputs is an extensible parameter in some blocks.
PRE_OUT	9					The pre-trip limit from SP or zero.
Process Value Scale PV_SCALE	10					The high and low scale values, engineering units code, and number of digits to the right of the decimal point associated with OUT.
Output Range OUT_RANGE	11		ALL		0	Data Type: Unsigned16 Range of the output.
Grant Deny GRANT_DENY	12					Data Type: DS-70 Options for controlling access of host computers and local control panels to operating, tuning, and alarm parameters of the block. GRANT: 0=NA, 1=granted DENY: 0=NA, 1=denied
GRANT	12.1		ALL	0: Program 1: Tune 2: Alarm 3: Local	All bits:0	
DENY	12.2		ALL		All bits: 0	
Input Options IO_OPTS	13					Sets the options for using IN, IN_LO, IN_1, IN_2, and IN_3 when any are either Bad or Uncertain.
Input IN	14		ALL	Status	BAD: NC: const	Data Type: DS-65 The analog input value and status. The number of inputs is an extensible parameter in some function blocks.
				Value	0	

-Continued-

Table B-42. Arithmetic Function Block Parameter Definitions (Continued)

Label PARAMETER_NAME	Index Number	RO / RW	Block Mode	Range	Initial Value	Description
Input Lo IN_LO	15					The value used for input whenever IN is below range.
Input 1 IN_1	16					The first analog input value and status.
Input 2 IN_2	17					The second analog input value and status.
Input 3 IN_3	18					The third analog input value and status.
Range High RANGE_HI	19					The high limit for IN.
Range Low RANGE_Lo	20					The low limit for IN. If IN is less than RANGE_LO, then IN_LO is used.
Bias Input 1 BIAS_IN_1	21					The bias value for IN_1.
Gain Input 1 GAIN_IN_1	22					The proportional gain (multiplier) value for IN_1
Bias Input 2 BIAS_IN_2	23					The bias value for IN_2.
Gain Input 2 GAIN_IN_2	24					The proportional gain (multiplier) value for IN_2
Bias Input 3 BIAS_IN_3	25					The bias value for IN_3.
Gain Input 3 GAIN_IN_3	26					The proportional gain (multiplier) value for IN_3
COMP_HI_LIM	27					High limit for the compensation term.
COMP_LO_LIM	28					Low limit for the compensation term.
ARITH_TYPE	29					Selects the computation to be used as the block function.
BAL_TIME	30					The time to balance OUT to PRE_OUT after the block enters Auto mode. It has no effect after the time expires.
BIAS	31					The bias value.
GAIN	32					The proportional gain (multiplier) value.
Output High Limit OUT_HI_LIM	33					The maximum output value allowed.
Output Low Limit OUT_LO_LIM	34					The minimum output value allowed.
UPDATE_EVT	35					This alert is generated by any changes to the static data.
Block Alarm BLOCK_ALM	36				Dynamic	Data Type: DS-72 The read-only data for an alarm generated by a change in BLOCK_ERR.
UNACKNOWLEDGED	36.1	RW	NA	0=Undefined 1=Acknowledged 2=Unacknowledged		
ALARM_STATE	36.2	RO	NA	0=Undefined 1=Clear reported 2=Clear not reported 3=Active reported 4=Active not reported		
TIME_STAMP	36.3	RO	NA			
SUBCODE	36.4	RO	NA			
VALUE	36.5	RO				

View Lists

View lists allow the values of a set of parameters to be accessed at the same time. Views 1 and 2 contain operating parameters and are defined by the Fieldbus Foundation. View 3 contains dynamic parameters and View 4 contains static parameters with configuration and maintenance information. Views 3 and 4 are defined by the manufacturer.

Table B-43. ARTH Function Block, View 1

Index Number	Parameter
1	ST_REV
5.1	MODE_BLK.TARGET_MODE
5.2	MODE_BLK.ACTUAL_MODE
5.3	MODE_BLK.PERMITTED_MODE
5.4	MODE_BLK.NORMAL_MODE
6	BLOCK_ERR
7	PV
8	OUT
9	PRE_OUT

Table B-44. ARTH Function Block, View 2

Index Number	Parameter
1	ST_REV
10	XD_STATE
11	OUT_STATE
12.1	GRANT_DENY.GRANT
12.2	GRANT_DENY.DENY

Table B-45. DI Function Block, View 3

Index Number	Parameter
1	ST_REV
5.1	MODE_BLK.TARGET_MODE
5.2	MODE_BLK.ACTUAL_MODE
5.3	MODE_BLK.PERMITTED_MODE
5.4	MODE_BLK.NORMAL_MODE
6	BLOCK_ERR
7	PV
8	OUT
9	PRE_OUT
14	IN
15	IN_LO
16	IN_1
17	IN_2
18	IN_3

Table B-46. DI Function Block, View 4

Index Number	Parameter
1	ST_REV
3	STRATEGY
4	ALERT_KEY
13	IN_OPTS
19	RANGE_HI
20	RANGE_LO
21	BIAS_IN_1
22	GAIN_IN_1
23	BIAS_IN_2
24	GAIN_IN_2
25	BIAS_IN_3
26	GAIN_IN_3
27	COMP_HI_LIM
28	COMP_LO_LIM
29	ARITH_TYPE
30	BAL_TIME
31	BIAS
32	GAIN
33	OUT_HI_LIM
34	OUT_LO_LIM

Resource Block

The resource block contains hardware specific characteristics associated with the device; it has no input or output parameters.

Resource Block Parameters

- Read/Write Capability: RO - Read Only, RW - Read Write
- Mode: The block mode(s) required to write to the parameter
- Double indentation and shaded Index Number indicates sub-parameter

Table B-47. Resource Block Parameter Definitions

Label PARAMETER_NAME	Index Number	RO / RW	Mode	Range	Initial Value	Description
Static Revision ST_REV	1	RO		0 to 65535	0	Data Type: Unsigned16 The revision level of the static data. Increments by one each time a static parameter changes. The value is reset to 0 whenever a Restart with Defaults is performed.
Tag Description TAG_DESC	2	RW		NA	NULL	Data Type: Octet String The user description of the intended application of the block.
Strategy STRATEGY	3	RW		0 to 65535	0	Data Type: Unsigned16 Used to help group blocks.
Alert Key ALERT_KEY	4	RW		1 to 255	1	Data Type: Unsigned8 The identification number of the plant unit. Devices in a loop or plant section can be assigned with a common alert key to aid the operator in determining location of alerts.
Block Mode MODE_BLK	5					
TARGET_MODE	5.1	RW		3: Auto 7: OOS	3: Auto	Data Type: DS-69 The actual, target, permitted, and normal modes. Target: The requested block mode Actual: The current mode of the block Permitted: Allowed modes for Target Normal: Most common mode for Target
ACTUAL_MODE	5.2	RO		3: Auto 7: OOS	NA	
PERMITTED_MODE	5.3	RW		3: Auto 7: OOS	3: Auto 7: OOS	
NORMAL_MODE	5.4	RW		3: Auto 7: OOS	3: Auto	
Block Error BLOCK_ERR	6	RO		3: Simulate Jumper Active 9: Memory Fail Bit 10: Static Memory Failed 13:Maintenance Needed Now 15: Out of Service	Dynamic	Data Type: Bit String 0 = Inactive 1 = Active Error status associated with hardware or software for the transducer block. When an error is shown it may be broadcast to the host through BLOCK_ALM.
Device State RS_STATE	7	RO		4: Online Actual Mode: Auto 5: Standby Actual Mode: OOS 6: Failure Actual Mode: OOS	4: Online	Data Type: Unsigned8 State of the function block application state machine.
Test Read Write TEST_RW	8				0	This parameter may be used in interoperability testing to read and write all standard data types supported by the Fieldbus Foundation.
DD Resource DD_RESOURCE	9	RO			Spaces	Data Type: Visible String String identifying the VFD tag of the resource that contains the Device Description for this resource.

-Continued-

Table B-47. Resource Block Parameter Definitions (Continued)

Label PARAMETER_NAME	Index Number	RO / RW	Mode	Range	Initial Value	Description
Manufacturer Id MANUFAC_ID	10	RO			0x5100	Data Type: Unsigned32 Manufacturer identification number, used by an interface device or host to locate the DD file for the resource. All manufacturer identification numbers are maintained by the Fieldbus Foundation. A host usually will have a base directory for DD files. In this directory is a subdirectory for each manufacturer id. In each manufacturer id subdirectory is a directory for each device type made by that manufacturer. The device type directories contain files named by combining the device revision for the particular device type with the revision of the device description. The manufacturer id for Fisher is 0x005100.
Device Type DEV_TYPE	11	RO			0x3020	Data Type: Unsigned16 Manufacturer's model number associated with the resource block, used by an interface device to locate the DD file for the resource.
Device Revision DEV_REV	12	RO			Varies with release	Data Type: Unsigned8 Manufacturer's revision number associated with the resource block, used by an interface device to locate the DD file for the resource.
DD Revision DD_REV	13	RO			Varies with release	Data Type: Unsigned8 The minimum revision of the device description (DD) than can be used with the device revision of the instrument. Used by the interface device to prevent the use of DDs that are incompatible with the firmware in the instrument.
Grant Deny GRANT_DENY	14					
GRANT	14.1	RW	ALL	Valid Bits: 0: Program 1: Tune 2: Alarm 3: Local	All bits: 0	Data Type: DS-70 Options for controlling access of a host computer and to block parameters. Parameter contains two attributes Grant and Deny each with program, tune, alarm and local permissions. Clearing a grant permission sets the corresponding deny permission, 0 = NA, 1 = granted. Deny permissions may be cleared through the Deny attribute but not set, 0 = NA, 1 = denied.
DENY	14.2	RW	ALL		All bits: 0	
Hard Types HARD_TYPES	15	RO	NA	0: Scalar Input 1: Scalar Output 2: Discrete Input	0: 1 1: 1 2: 1	Data Type: Bit String 0 = Inactive 1 = Active The types of hardware available as channel numbers in this resource.
Restart RESTART	16	RW		1: Run 2: Restart resource 3: Restart with defaults 4: Restart processor	1: Run	Data Type: Unsigned8 Allows a manual restart to be initiated.
Features FEATURES	17	RO		1: Reports supported 2: Fault State 3: Software Write lock supported 10: Reannunciation supported	1, 2, 3, 10	Data Type: Bit String 0 = Inactive 1 = Active Shows the supported resource block options. Options are turned on and off via FEATURE_SELECT.
Features Select FEATURE_SEL	18	RW		1: Reports Supported 2: Fault State 3: Software Write lock supported 10:Reannunciation supported	1, 2, 3	Data Type: Bit String 0: Inactive 1: Active Shows the selected resource block options.

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Table B-47. Resource Block Parameter Definitions (Continued)

Label PARAMETER_NAME	Index Number	RO / RW	Mode	Range	Initial Value	Description
Cycle Type CYCLE_TYPE	19	RO		0: Cycle Scheduled 1: Cycle Block Completion	0, 1	Data Type: Bit String 0: Inactive 1: Active Identifies the block execution methods available for this resource, may be scheduled, completion of block execution
Cycle Selection CYCLE_SEL	20			0: Cycle Scheduled 1: Cycle Block Completion	None	Data Type: Bit String 0 = Inactive 1 = Active Identifies the block execution method selected for this resource.
Minimum Cycle Time MIN_CYCLE_T	21	RO		1760	1760	Data Type: Unsigned32 Time duration of the shortest cycle interval (in 1/32 millisecond) of which the resource is capable.
Memory Size MEMORY_SIZE	22	RO		NA	16	Date Type: Unsigned16 Memory, in kilobytes, available for additional function blocks.
Nonvolatile Cycle Time NV_CYCLE_T	23	RO		>0	960000 (30secs)	Date Type: Unsigned32 This parameter identifies the minimum time interval (in 1/32 milliseconds) between copies of NV class data to NV memory. NV memory is updated only if there has been a change in the dynamic value. The last value saved in NV memory will be available for the restart procedure or a power cycle. A non-zero value regulates the frequency of writes, thus protecting the life span of the device. If the value is zero, data will never be automatically copied. Changes made by other than publishing to NV parameters will be copied to non-volatile memory immediately.
Free Space FREE_SPACE	24	RO		0 to 100%	13.6719	Data Type: Float Percent of memory available for additional function blocks (see also MEMORY_SIZE).
Free Time FREE_TIME	25	RO		0 to 100%	0	Data Type: Float Percent of block processing time that is free to process additional blocks.
RCAS Timeout SHED_RCAS	26	RW		>0	640000	Date Type: Unsigned32 Time duration (in 1/32 millisecond) at which to give up on computer writes to function block RCAS parameters. If this time is exceeded then the function block will change to a mode other than RCAS based on the SHED_OPT parameter setting. Shed from RCAS mode never happens when SHED_RCAS is set to zero.
ROUT Timeout SHED_ROUT	27	RW		>0	640000	Data Type: Unsigned32 Time duration (in 1/32 millisecond) at which to give up on computer writes to function block ROUT parameters. If this time is exceeded then the function block will change to a mode other than ROUT based on the SHED_OPT parameter setting. Shed from ROUT mode never happens when SHED_ROUT is set to zero.
Fail Safe FAIL_SAFE	28	RO		1: Clear 2: Active	1: Clear	Data Type: Unsigned8 Condition set by loss of communication to an output block, failure promoted to an output block or a physical contact. When fault state condition is set, then output function blocks will perform FSTATE actions.

-Continued-

Table B-47. Resource Block Parameter Definitions (Continued)

Label PARAMETER_NAME	Index Number	RO / RW	Mode	Range	Initial Value	Description
Set Fault State SET_FSTATE	29	RW		1: Off 2: Set	1: Off	Data Type: Unsigned8 Selecting Set changes the parameter FAULT_STATE to Active. This is essentially a "write only" parameter as it will always read OFF because it is defined as momentary. Writing a value of OFF has no affect. To use this parameter the feature Fault State must be selected
Clear Fault State CLR_FSTATE	30	RW		1: Off 2: Clear	1: Of	Data Type: Unsigned8 Selecting Clear changes the parameter FAULT_STATE to Clear and clears the output function blocks of the FAULT_STATE if the field condition, if any, has cleared. This is essentially a "write only" parameter as it will always read OFF because it is defined as momentary. Writing a value of OFF has no affect. To use this parameter the feature Fault State must be selected.
Maximum Notify MAX_NOTIFY	31	RO		0-3	5	Data Type: Unsigned8 The maximum number of alert reports that this device can send without getting a confirmation. To control alert flooding, the number can be set lower by adjusting the LIM_NOTIFY parameter value.
Maximum Alerts Allow LIM_NOTIFY	32	RW		0 to MAX_NOTIFY	MAX_NOTIFY	Data Type: Unsigned8 The number of alert reports that this device can send without getting a confirmation up to the maximum permitted in the parameter MAX_NOTIFY. If set to zero, then no alerts are reported.
Confirm Time CONFIRM_TIME	33	RW		> 0	640000	Data Type: Unsigned32 The time (in 1/32 millisecond) the device waits for confirmation of receipt of an alert report before trying again.
Write Lock WRITE_LOCK	34	RW		0: Undefined 1: Unlocked 2: Locked	1: Unlocked	Data Type: Unsigned8 If set to Locked, no writes from anywhere are allowed except to clear WRITE_LOCK by entering Unlocked. Block inputs will continue to be updated if they are subscribers. The feature Soft Write Lock must be selected to enable writing to this parameter.
Update Event UPDATE_EVT	35					
UNACKNOWLEDGED	35.1	RW		0: Undefined 1: Acknowledged 2: Unacknowledged	0: Undefined	Data Type: DS-73 This alert is generated by any change to the static data. To support tracking changes in static parameter values, the blocks static revision parameter will be incremented each time a static parameter value is changed. Also, the blocks static revision parameter may be incremented if a static parameter is written but the value is not changed. If the Actual Mode is not Out of Service and Reports is selected in the Feature Select parameter, then this parameter will be sent to the host system providing the host has set up alert communications. Changes to static data while the block is Out of Service will be reported when the block transitions to another mode.
UPDATE_STATE	35.2	RO		0: Undefined 1: Update reported 2: Update not reported	0: Undefined	
TIME_STAMP	35.3	RO				
STATIC_REVISION	35.4	RO				
RELATIVE_INDEX	35.5	RO				

-Continued-

Table B-47. Resource Block Parameter Definitions (Continued)

Label PARAMETER_NAME	Index Number	RO / RW	Mode	Range	Initial Value	Description
Block Alarm BLOCK_ALM	36					
UNACKNOWLEDGED	36.1	RW	ALL	0: Undefined 1: Acknowledged 2: Unacknowledged	0: Undefined	Data Type: DS-72 This alarm is generated by a nonzero value in the Block Error parameter. This alarm has a fixed priority of 2. For a BLOCK_ALM to be broadcast to the host the following conditions must be met: The feature Reports must be selected Alert communication with the host must be setup In the ALARM_SUM parameter, the disable bit for Block Alarm must be clear.
ALARM_STATE	36.2	RO	NA	0: Undefined 1: Clear (Reported) 2: Clear (Not Reported) 3: Active (Reported) 4: Active (Not Reported)	0: Undefined	
TIME_STAMP	36.3	RO	NA		0	
SUBCODE	36.4	RO	NA		0	
VALUE	36.5	RO	NA		0	
Alarm Summary ALARM_SUM	37					
CURRENT	37.1	RO		0: Discrete alarm 7: Block Alarm	All bits: 0	Data Type: DS-74 0=clear, acknowledged, reported, enabled Current alert status, unacknowledged states, unreported states, and disabled states of the alarms associated with the function block. The Resource block only has two alarms: Write Alarm and Block Alarm.
UNACKNOWLEDGED	37.2	RO		0: Discrete alarm 7: Block Alarm	All bits: 0	
UNREPORTED	37.3	RO		0: Discrete alarm 7: Block Alarm	All bits: 0	
DISABLED	37.4	RW		0: Discrete alarm 7: Block Alarm	All bits: 0	
Acknowledge Option ACK_OPTION	38	RW		0: Discrete Alarm (Write Lock off) 7: Block Alarm	0: 0 7: 0	Data Type: Bit String 0=Disable 1=Enable Selection of whether alarms associated with the block will be automatically acknowledged.
Write Priority WRITE_PRI	39	RW		0 to 15	0	Data Type: Unsigned8 Priority of the alarm generated by setting WRITE_LOCK to Unlocked.
Write Alarm WRITE_ALM	40					Data Type: DS-72 This alarm is generated when Unlocked in the WRITE_LOCK parameter is set. This alarm has a priority of WRITE_PRI. For a WRITE_ALM to be broadcast to the host the following conditions must be met: The feature Reports must be selected Alert communication with the host must be setup In the ALARM_SUM parameter, the disable bit for Write Alarm must be clear. WRITE_PRI must be greater than 1.
UNACKNOWLEDGED	40.1	RW	NONE	0: Undefined 1: Acknowledged 2: Unacknowledged	0: Undefined	
ALARM_STATE	40.2	RO	NA	0: Undefined 1: Clear (Reported) 2: Clear (Not Reported) 3: Active (Reported) 4: Active (Not Reported)	0: Undefined	
TIME_STAMP	40.3	RO	NA		0	
SUBCODE	40.4	RO	NA		0	
VALUE	40.5	RO	NA		0	
ITK Version ITK_VER	41	RO			*	Data Type: Unsigned16 Major version of ITK test this device has been tested to. *Initial value depends on the revision of the DLC3020f
Extended Parameters						
Device String Array DEV_STRING	42					Unused extended parameter.
Function Block Options FB_OPTIONS	43	RO		Bit 0: CasIn to TB: When in Cas mode, the CasIn is written to the TB instead of Out	Bit 0	Data Type: Bit String Function block options.
Diagnostic Options DIAG_OPTIONS	44	RO		-	-	Data Type: Enum

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Table B-47. Resource Block Parameter Definitions (Continued)

Label PARAMETER_NAME	Index Number	RO / RW	Mode	Range	Initial Value	Description
Miscellaneous Options MISC_OPTIONS	45	RO		Bit 0: Software download	-	Data Type: Bit String
Firmware Revision FIRMWARE_REVISION	46					Data Type: Uint8 Describes software revision information. This is the revision of the firmware that is currently in use.
FIRMWARE_REV_MAJOR	46.1	RO		NA	NA	
FIRMWARE_REV_MINOR	46.2	RO		NA	NA	
FIRMWARE_REV_BUILD	46.3	RO		NA	NA	
IO_FIRMWARE_REV	46.4	RO		NA	NA	
DIAG_CAL_REV	46.5	RO		NA	NA	
FIRMWARE_REV_ALL	46.6	RO		NA	NA	Data Type: Visible String Describes software revision information.
Hardware Revision HARDWARE_REV	47	RO		NA	NA	Data Type: Uint8 Describe electronic hardware revision information.
LABEL_SITE_ID	48	RO		NA	NA	Data Type: Visible String Fisher entity code for site that applies the serial plate to the instrument.
Instrument Model Number INSTR_MODEL_NUM	49	RO		NA	NA	Data Type: Visible String
SALE_SITE_ID	50	RO		NA	NA	Data Type: Visible String Fisher entity code for sales site that ships the instrument to the customer
Shop Order Number SHOP_ORDER_NO	51	RO		NA	NA	Data Type: Uint32 Tracking string associated with a batch of instruments manufactured together, usually over the timeframe of a week or two.
HI_POT_TEST_DATE	52	RO		NA	NA	Data Type: Visible String Date on which this instrument passed the dielectric strength test required by the hazardous area approval.
Terminal Box ID TERM_BOX_ID	53	RO		NA	NA	Data Type: Visible String String that encodes the year and week during which the terminal box was manufactured.
LEVER_ASSY_ID	54	RO		NA	NA	Data Type: Visible String String that identifies the magnet / lever assembly processing batch.
COMM_MODULE_ID	55	RO		NA	NA	Data Type: Visible String Unique string identifying the communications module test record in the manufacturing test data base.
DETAILED STATUS	56	RW		Bit 28	28:NV Integrity Error	Data Type: Bit String NV Integrity Error will activate when there is a problem reading a non-transducer block parameter from non-volatile memory.

View Lists

View lists allow the values of a set of parameters to be accessed at the same time. Views 1 and 2 contain operating parameters and are defined by the Fieldbus Foundation. View 3 contains dynamic parameters and View 4 contains static parameters with configuration and maintenance information. Views 3 and 4 are defined by the manufacturer.

Table B-48. Resource Block, View 1

Index Number	Parameter
1	ST_REV
5.1	MODE_BLK.TARGET_MODE
5.2	MODE_BLK.ACTUAL_MODE
5.3	MODE_BLK.PERMITTED_MODE
5.4	MODE_BLK.NORMAL_MODE
6	BLOCK_ERR
7	RS_STATE
25	FREE_TIME
28	FAIL_SAFE
37.1	ALARM_SUM.CURRENT
37.2	ALARM_SUM.UNACKNOWLEDGED
37.3	ALARM_SUM.UNREPORTED
37.4	ALARM_SUM.DISABLED

Table B-49. Resource Block, View 2

Index Number	Parameter
1	ST_REV
14.1	GRANT_DENY.GRANT
14.2	GRANT_DENY.DENY
18	FEATURE_SEL
20	CYCLE_SEL
23	NV_CYCLE_T
24	FREE_SPACE
26	SHED_RCAS
27	SHED_ROUT
32	LIM_NOTIFY
33	CONFIRM_TIME
34	WRITE_LOCK

Table B-50. Resource Block, View 3

Index Number	Parameter
1	ST_REV
5.1	MODE_BLK.TARGET_MODE
5.2	MODE_BLK.ACTUAL_MODE
5.3	MODE_BLK.PERMITTED_MODE
5.4	MODE_BLK.NORMAL_MODE
6	BLOCK_ERR
7	RS_STATE
25	FREE_TIME
28	FAIL_SAFE
37.1	ALARM_SUM.CURRENT
37.2	ALARM_SUM.UNACKNOWLEDGED
37.3	ALARM_SUM.UNREPORTED
37.4	ALARM_SUM.DISABLED
56	DETAILED_STATUS

Note

Because individual views are limited in size, View List 4 has three parts.

Table B-51. Resource Block, View 4.1

Index Number	Parameter
1	ST_REV
3	STRATEGY
4	ALERT_KEY
10	MANUFAC_ID
11	DEV_TYPE
12	DEV_REV
13	DD_REV
15	HARD_TYPES
17	FEATURES
19	CYCLE_TYPE
21	MIN_CYCLE_T
22	MEMORY_SIZE
31	MAX_NOTIFY
38	ACK_OPTION
39	WRITE_PRI
41	ITK_VER

Table B-52. Resource Block, View 4.2

Index Number	Parameter
1	ST_REV
43	FB_OPTIONS
44	DIAG_OPTIONS
45	MISC_OPTIONS
46.1	FIRMWARE_REVISION.FIRMWARE_REV_MAJOR
46.2	FIRMWARE_REVISION.FIRMWARE_REV_MINOR
46.3	FIRMWARE_REVISION.FIRMWARE_REV_BUILD
46.4	FIRMWARE_REVISION.IO_FIRMWARE_REV
46.5	FIRMWARE_REVISION.DIAG_CAL_REV
46.6	FIRMWARE_REVISION.FIRMWARE_REV_ALL
47	HARDWARE_REV

Table B-53. Resource Block, View 4.3

Index Number	Parameter
1	ST_REV
48	LABEL_SITE_ID
49	INSTR_MODEL_NUM
50	SALE_SITE_ID
51	SHOP_ORDER_NO
52	HI_POT_TEST_DATE
53	TERM_BOX_ID
54	LEVER_ASSY_ID
55	COMM_MODULE_ID

Transducer Block (Primary)

Transducer blocks connect function blocks to local input/output functions. They read sensor hardware and write to effector (actuator) hardware.

Transducer Block (Primary) Parameters

- Read/Write Capability: RO - Read Only, RW - Read Write
- Mode: The block mode(s) required to write to the parameter
- Double indentation and shaded Index Number indicates sub-parameter

Table B-54. Primary Transducer Block Parameter Definitions

Label PARAMETER_NAME	Index Number	RO / RW	Mode	Range	Initial Value	Description
Static Revision ST_REV	1	RO	NA	0 to 65535	0	Data Type: Uint16 The revision level of the static data. Increments by one each time a static parameter is written. The value is reset to 0 whenever a Restart with Defaults is performed.
Tag Description TAG_DESC	2	RW		NA	NULL	Data Type: String The description of the block.
Strategy STRATEGY	3	RW	AUTO	0 to 65535	0	Data Type: Uint16 Used to help group blocks.
Alert Key ALERT_KEY	4	RW	AUTO	1 to 255	1	Data Type: Uint8 The identification number of the plant unit. Devices in a loop or plant section can be assigned with a common alert key to aid the operator in determining location of alerts.
Block Mode MODE_BLK	5					Data Type: DS-69 The actual, target, permitted, and normal modes. Target: The requested block mode Actual: The current mode of the block Permitted: Allowed modes for Target Normal: Most common mode for Target
TARGET	5.1	RW	AUTO	3: AUTO 7: OOS	7: OOS	
ACTUAL	5.2	RO			NA	
PERMITTED	5.3	RW	AUTO		3:AUTO 7: OOS	
NORMAL	5.4	RW	AUTO		3:AUTO	
Block Error BLOCK_ERR	6	RO		3: Simulate Active 9: Memory Fail Bit 10: Static Memory Failed 13: Maintenance Needed Now 15: Out-of-Service	NA	Data Type: Bit String (2 byte) Error status associated with hardware or firmware for the transducer block.
Update Event UPDATE_EVT	7					
UNACKNOWLEDGED	7.1	RW		0=Undefined 1=Acknowledged 2=Unacknowledged	0	Data Type: DS-73 Alert generated by change to static data.
UPDATE_STATE	7.2	RO	NA	0=Undefined 1=Updated reported 2=Update Not reported	0	
TIME_STAMP	7.3	RO	NA		0	
STATIC_REVISION	7.4	RO	NA		0	
RELATIVE_INDEX	7.5	RO	NA		0	

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Table B-54. Primary Transducer Block Parameter Definitions (Continued)

Label PARAMETER_NAME	Index Number	RO / RW	Mode	Range	Initial Value	Description
Block Alarm BLOCK_ALM	8					
UNACKNOWLEDGED	8.1	RW		0=Undefined 1=Acknowledged 2=Unacknowledged	0	Data Type: DS-72 Used to report the BLOCK_ERR alarm to the host system
ALARM_STATE	8.2	RO	NA	0=Undefined 1=Clear-reported 2=Clear-not reported 3=Active-reported 4=Active-not reported	0	
TIME_STAMP	8.3	RO	NA	NA	0	
SUBCODE	8.4	RO	NA	Subcode: Bit Number in BLOCK_ERR	0	
VALUE	8.5	RO	NA	Value of parameter at alarm time for a single alarm, 0 for multiple alarms	0	
Transducer Directory TRANSDUCER_DIRECTORY	9	RO	NA	1,1		Data Type: Array [2] of Unit16 Not used
Transducer Type TRANSDUCER_TYPE	10	RO	NA			Data Type: Uint16 Identifies the type of transducer.
Transducer Error XD_ERROR	11	RO	NA	NA	0	Data Type: Uint8 Error code for the transducer block.
Collection Directory COLLECTION_DIRECTORY	12	RO	NA	1,1,1,1,1	1,1,1,1,1	Data Type: Array [5] of Unit32 Not used
PRIMARY_VALUE_TYPE	13	RW	OOS	1: Level 2: Interface	1: Level	Data Type: Enum(2) Type of measurement application (level, interface).
PRIMARY_VALUE	14					Data Type: DS-65
STATUS	14.1	RO	NA	NA	NA	Data Type: Uint8 Primary value status
VALUE	14.2	RO	NA	NA	NA	Data Type: Float 0% = PRIMARY_VALUE_RANGE. LOWER, 100% = PRIMARY_ VALUE_RANGE.UPPER
PRIMARY_VALUE_RANGE	15					Data Type: DS-68 Range the PRIMARY_VALUE can take. Defaults to displacer length and includes PV_OFFSET
EU_100	15.1	RW	OOS	NA	14	Data Type: Float Upper range for PRIMARY_VALUE
EU_0	15.2	RW	OOS	NA	0	Data Type: Float Lower range for PRIMARY_VALUE
ENG_UNITS	15.3	RW	OOS	1010: Meter 1012: cm 1013: mm 1018: ft. 1019: in.	1012: cm	Data Type: Float Engineering units for EU_100 & EU_0
DECIMAL	15.4	RW	OOS	2	2	
Sensor Type SENSOR_TYPE	16	RW	OOS	107	107	Data Type: Uint16 Positive Displacement
Sensor Range SENSOR_RANGE	17					Data Type: DS-68 Physical sensor limits
EU_100	17.1	RO	OOS	NA	14	Data Type: Float Maximum readable level the digital level controller can currently read
EU_0	17.2	RO	OOS	NA	0	Data Type: Float Minimum readable level the digital level controller can currently read

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Table B-54. Primary Transducer Block Parameter Definitions (Continued)

Label PARAMETER_NAME	Index Number	RO / RW	Mode	Range	Initial Value	Description
ENG_UNITS	17.3	RO	OOS	1010: Meter 1012: cm 1013: mm 1018: ft. 1019: in. 1342: Percent	1342: Percent	Data Type: Float
DECIMAL	17.4	RO	OOS		2	Data Type: Float
Sensor Serial Number SENSOR_SN	18	RO	NA			Data Type: Visible String [32]
Sensor Calibration Method SENSOR_CAL_METHOD	19	RW	OOS	240: Weights 241: Min/Max (Zero Span) 242: Two Point (Not Zero Span) 243: Zero Capture 244: Gain Trim 245: Zero Trim 246: Default Gain 247: Simple Two Point Cal 248: Simple Gain Trim 249: Simple Zero Trim 250: Simple Zero Capture 251: Factory Default	251: Factory Default	Data Type: Uint8 Previous calibration method.
Sensor Calibration Location SENSOR_CAL_LOC	20	RW	OOS	NA	NULL	Data Type: Visible String [32] Calibration location
Sensor Calibration Date SENSOR_CAL_DATE	21	RW	OOS	NA	NA	Data Type: DT-11 Calibration date
SENSOR_CAL_WHO	22	RW	OOS	NA	NULL	Data Type: Visible String [32] Calibrator
SENSOR_LOG_NAME	23	RW	OOS	NA	Factory Default	Data Type: Visible String [16] Name of the current log in use as entered by the user
Sensor Information SENSOR_INFO	24					Data Type: DS-268 Sensor information.
Sensor Type SENSOR_TYPE	24.1	RW	OOS	1: 249 Cast 2: 249A 3: 249B 4: 249BF 5: 249C 6: 249K 7: 249L 8: 249N 9: 249P 10: 249V 11: 249VS 12: 249W 13: 259 14: Masoneilan 15: Foxboro Eckardt 16: Yamatake Honeywell 17: Other 255: Unknown	255: Unknown	Data Type: Enum (1)

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Table B-54. Primary Transducer Block Parameter Definitions (Continued)

Label PARAMETER_NAME	Index Number	RO / RW	Mode	Range	Initial Value	Description
End Connection Style END_CONNECTION_STYLE	24.2	RW	OOS	1: BW3 2: F1 3: F2 4: F3 5: F4 6: S1 7: S2 8: S3 9: S4 255: Unknown	255: Unknown	Data Type: Enum (1)
Torque Tube Wall TT_WALL	24.3	RW	OOS	1: Thin 2: Standard 3: Heavy 255: Unknown	255: Unknown	Data Type: Enum (1)
Pressure Rating PRESSURE_RATING	24.4	RW	OOS		0	Data Type: Float
End Connection Type END_CONNECTION_TYPE	24.5	RW	OOS	1: Screwed 2: Flanged 255: Unknown	255: Unknown	Data Type: Enum (1)
Displacer Size DISPLACER_SIZE	24.6	RW	OOS		“Unknown”	Data Type: Visible String [16]
Displacer Material DISPLACER_MTL	24.7	RW	OOS	1: SS316 2: SS304 3: Hastelloy B 4: Monel 5: Plastic 6: Special 255: Unknown	255: Unknown	Data Type: Enum (1)
Displacer Rating DISPLACER_RATING	24.8	RW	OOS	1: 1400 2: 1600 3: 2100 4: 4000 255: Unknown	255: Unknown	Data Type: Enum (1)
G Dimension G_DIMEN	24.9	RW	OOS		0	Data Type: Float
Body material BODY_MTL	24.10	RW	OOS	1: Cast 2: Steel 3: SS 255: Unknown	255: Unknown	Data Type: Enum (1)
Mechanical Sensor Serial Number MECHANICAL_SENSOR_SN	24.11	RW	OOS		“Unknown”	Data Type: Visible String[16] Mechanical Sensor serial number
Heat Insulator HEAT_INSULATOR	24.12	RW	OOS	0: No insulator 1: Insulator 255: “Unknown"	255: “Unknown"	Data Type: Enum (1)
Torque Tube Material TT_MATERIAL	24.13	RW	OOS	0: Other 1: Nickel N02202 2: Dura Nickel N03301 3: Monel N04400 4: Kmonel N05500 5: Inconel N06600 6: Alloy N08020 7: Incoloy N0880 8: Hasteloy C-N10276 9: Hasteloy B2-N10665 10: 304 SST-S30400 11: 304L SST-S30403 12: 316 SST-31600 13: 316L SST-1603 14: 321 SST-S32100 15: 347 SST-S34700 255: Unknown	255: Unknown	Data Type: Enum (1)

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Table B-54. Primary Transducer Block Parameter Definitions (Continued)

Label PARAMETER_NAME	Index Number	RO / RW	Mode	Range	Initial Value	Description
Digital Level Controller Units DLC_UNITS	25					Data Type: DS-269 Global units for primary transducer block
Unit System UNIT_SYSTEM	25.1	RW	AUTO	1: English 2: Metric 3: Mixed	2	Data Type: Enum (1) Unit System
Length Units LENGTH_UNITS	25.2	RW	OOS	1010: Meter 1012: cm 1013: mm 1018: ft. 1019: in.	1012: cm	Data Type: Enum (2) Unit of length for displacer and driver rod.
Volume Units VOLUME_UNITS	25.3	RW	OOS	1037: mm3 1038: Liters 1040: mL 1042: in3	1040: mL	Data Type: Enum (2) Unit of volume for displacer.
Weight Units WEIGHT_UNITS	25.4	RW	OOS	1088: kilogram 1089: gram 1093: oz 1094: lb	1088: kg	Data Type: Enum (2) Unit of weight for displacer.
Temperature Units TEMPERATURE_UNITS	25.5	RW	OOS	1001: Celsius 1002: Fahrenheit 1000: Kelvin 1003: Rankine	1001: °C	Data Type: Enum (2) Unit of temperature.
Density Units DENSITY_UNITS	25.6	RW	OOS	1097: kg/m3 1100: g/cm3 1103: kg/L 1104: g/mL 1105: g/L 1106: lb/in3 1107: lb/ft3 1108: lb/gal 1111: degBaum hv 1112: degBaum lt 1113: degAPI 1114: SGU	1114: SGU	Data Type: Enum (2) Unit of density.
Torque Rate Units TORQUE_RATE_UNITS	25.7	RW	OOS	1686: lbf-in per deg (pounds-force inches per degree rotation) 1687: newton-m per deg (newton-meters per degree rotation) 1688: dyne-cm per deg (dyne-centimeters per degree rotation)	1687: newton-m per deg	Data Type: Enum (2) Unit of torque rate.
Pressure Units PRESSURE_UNITS	25.8	RW	OOS	1130: Pa 1137: Bar 1140: atm 1143: psig 1142: psia	1130: Pa	Data Type: Enum (2) Unit of pressure.
Digital Level Controller Sensor Parameters DLC_SENSOR_PARAM	26					Data Type: DS-270
Displacer Length DISPLACER_LENGTH	26.1	RW	OOS	> 0	35.56 cm	Data Type: Float Length of the displacer in engineering units
Displacer Volume DISPLACER_VOLUME	26.2	RW	OOS	> 0	1622.32 mL	Data Type: Float The scale factor relating the density of the process fluid to the maximum force that can be produced as an input to the driver rod of the sensor
Displacer Weight DISPLACER WEIGHT	26.3	RW	OOS	> 0	2.15456 kg	Data Type: Float Weight of the displacer being used
Driver Rod Length DRIVER_ROD_LENGTH	26.4	RW	OOS	> 0	20.32 cm	Data Type: Float The scale factor (moment arm) between a force input to the sensor driver rod and the torque developed as input to the torque tube

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Table B-54. Primary Transducer Block Parameter Definitions (Continued)

Label PARAMETER_NAME	Index Number	RO / RW	Mode	Range	Initial Value	Description
Mounting Position MOUNT_POSITION	27	RW	OOS	1: Left of Displacer 2: Right of Displacer	2: Right of Displacer	Data Type: Enum (1) Selects on which side of the displacer the DLC3020f is mounted
PV_PERCENT	28					Data Type: DS-65 Primary value in terms of percent base on PV range
STATUS	28.1	RO	NA	NA	NA	Data Type: Uint8 Primary Value status
VALUE	28.2	RO	NA	NA	NA	Data Type: Float 0% = PRIMARY_VALUE_RANGE. LOWER, 100% = PRIMARY_ VALUE_RANGE.UPPER
PV_OFFSET	29	RW	OOS	NA	0	Data Type: Float The zero reference for the output of the PV calculation, referred to the location of the bottom of the displacer at zero differential buoyancy condition. Units are in PRIMARY_VALUE_RANGE.UNITS
TEMP_COMP_SELECT	30	RW	OOS	0: None 1: Manual 2: AO Block 3: RTD	0: None	Data Type: Enum (1) The input selection of temperature source for temperature compensation
COMP_TEMPERATURE	31					Data Type: DS-65 A user inputted process temperature. It can be used for temperature compensation instead of temperature compensation from the AO block or RTD or Manual
STATUS	31.1	RO	NA	NA	NA	Data Type: Uint8
VALUE	31.2	*RW	OOS	-127 to 426°C		Data Type: Float *RW when TEMP_COMP_SELECT is set to Manual otherwise RO
Torque Tube Material TORQUE_TUBE_MTL	32	RW	OOS	0: Other 1: Nickel N02202 2: Dura Nickel N03301 3: Monel N04400 4: Kmonel N05500 5: Inconel N06600 6: Alloy N08020 7: Incoloy N0880 8: Hasteloy C-N10276 9: Hasteloy B2-N10665 10: 304 SST-S30400 11: 304L SST-S30403 12: 316 SST-31600 13: 316L SST-1603 14: 321 SST-S32100 15: 347 SST-S34700 255: Unknown	4: Kmonel	Data Type: Enum (1) Selected torque tube material for torque tube temperature compensation. 0xff - Custom option lets user adjust TORQUE_TUBE_ TABLE for custom torque rates.
Torque Tube Table TORQUE_TUBE_TBL	33		OOS			Data Tu[e" DS-256 Torque tube correction table being used.
COMP_TEMP_1	33.1	*RW	OOS	146 to 699 K	255.372K	Data Type: Float *Parameter is RW only when TORQUE_TUBE_MATERIAL is set to custom.
COMP_GAIN_1	33.2	*RW	OOS	> = 0, < 2	1.0024	
COMP_TEMP_2	33.3	*RW	OOS	146 to 699 K	294.261K	

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Table B-54. Primary Transducer Block Parameter Definitions (Continued)

Label PARAMETER_NAME	Index Number	RO / RW	Mode	Range	Initial Value	Description
COMP_GAIN_2	33.4	*RW	OOS	> = 0, < 2	1	Data Type: Float *Parameter is RW only when TORQUE_TUBE_MATERIAL is set to custom.
COMP_TEMP_3	33.5	*RW	OOS	146 to 699 K	310.928K	
COMP_GAIN_3	33.6	*RW	OOS	> = 0, < 2	0.9982	
COMP_TEMP_4	33.7	*RW	OOS	146 to 699 K	366.483K	
COMP_GAIN_4	33.8	*RW	OOS	> = 0, < 2	0.9923	
COMP_TEMP_5	33.9	*RW	OOS	146 to 699 K	422.039K	
COMP_GAIN_5	33.10	*RW	OOS	> = 0, < 2	0.9865	
COMP_TEMP_6	33.11	*RW	OOS	146 to 699 K	477.594K	
COMP_GAIN_6	33.12	*RW	OOS	> = 0, < 2	0.9808	
COMP_TEMP_7	33.13	*RW	OOS	146 to 699 K	533.15K	
COMP_GAIN_7	33.14	*RW	OOS	> = 0, < 2	0.9692	
COMP_TEMP_8	33.15	*RW	OOS	146 to 699 K	588.706K	
COMP_GAIN_8	33.16	*RW	OOS	> = 0, < 2	0.9577	
COMP_TEMP_9	33.17	*RW	OOS	146 to 699 K	644.261K	
COMP_GAIN_9	33.18	*RW	OOS	> = 0, < 2	0.9385	
COMP_TEMP_10	33.19	*RW	OOS	146 to 699 K	699.817K	
COMP_GAIN_10	33.20	*RW	OOS	> = 0, < 2	0.9192	
Torque Tube Compensation TORQUE_TUBE_COMP	34	RO	NA	NA	NA	Data Type: DS-65
STATUS	34.1	RO	NA	NA	NA	Data Type: Uint8 Status of the compensated torque tube value.
VALUE	34.2	RO	NA	NA	NA	Data Type: Float Compensated torque rate being used for PV compensation
Upper Fluid Type UPPER_FLUID_TYPE	35					
TYPE	35.1	RW	OOS	0: Air/None 1: Water 65534: Custom 65535: AO Block	0	Data Type: Enum (2) Enumeration for the type of upper fluid. Only writable if in interface mode through parameter PRIMARY_VALUE_TYPE
BASE_DENSITY	35.2	*RW	OOS	> 0	0	Base density of fluid at room temperature. If type is custom, then non temperature compensated value is entered and saved here. *Writable but the device will adjust to the closest value it can on write when it's not a custom base density they are entering.
CUSTOM_NAME	35.3	*RW	OOS		NULL	Name of the custom fluid entered. If type is not custom, then nothing will be shown on a read. *Writable if type fluid is set to custom.
Upper Density UPPER_DENSITY	36					Data Type: DS-65 Upper fluid density. If level mode, upper fluid is air. E.g. density = 0 in case of SG.

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Table B-54. Primary Transducer Block Parameter Definitions (Continued)

Label PARAMETER_NAME	Index Number	RO / RW	Mode	Range	Initial Value	Description
STATUS	36.1	RO	NA	NA	NA	Data Type: Uint8 Status of upper fluid density value
VALUE	36.2	RO	NA	NA	NA	Data Type: Float Upper fluid density value
UPPER_TBL	37					Data Type: DS-257 Density correction table for upper fluid. *When UPPER_FLUID_ TYPE.TYPE is set to custom, this parameter becomes RW.
COMP_TEMP_1	37.1	*RW	OOS	146 to 699 K	0	Data Type: Float
UPPER_DENSITY_1	37.2	*RW	OOS	> = 0	0	
COMP_TEMP_2	37.3	*RW	OOS	146 to 699 K	0	
UPPER_DENSITY_2	37.4	*RW	OOS	> = 0	0	
COMP_TEMP_3	37.5	*RW	OOS	146 to 699 K	0	
UPPER_DENSITY_3	37.6	*RW	OOS	> = 0	0	
COMP_TEMP_4	37.7	*RW	OOS	146 to 699 K	0	
UPPER_DENSITY_4	37.8	*RW	OOS	> = 0	0	
COMP_TEMP_5	37.9	*RW	OOS	146 to 699 K	0	
UPPER_DENSITY_5	37.10	*RW	OOS	> = 0	0	
COMP_TEMP_6	37.11	*RW	OOS	146 to 699 K	0	
UPPER_DENSITY_6	37.12	*RW	OOS	> = 0	0	
COMP_TEMP_7	37.13	*RW	OOS	146 to 699 K	0	
UPPER_DENSITY_7	37.14	*RW	OOS	> = 0	0	
COMP_TEMP_8	37.15	*RW	OOS	146 to 699 K	0	
UPPER_DENSITY_8	37.16	*RW	OOS	> = 0	0	
COMP_TEMP_9	37.17	*RW	OOS	146 to 699 K	0	
UPPER_DENSITY_9	37.18	*RW	OOS	> = 0	0	
COMP_TEMP_10	37.19	*RW	OOS	146 to 699 K	0	
UPPER_DENSITY_10	37.20	*RW	OOS	> = 0	0	
Lower Fluid Type LOWER_FLUID_TYPE	38					
TYPE	38.1	RW	OOS	> 0	1	Data Type: Enum (2) Enumeration for the type of lower fluid.
BASE_DENSITY	38.2	*RW	OOS	> 0	1	Base density of fluid at room temperature. If type is custom, then non temperature compensated value is entered and saved here. Writable but the device will adjust to the closest value it can on write when it's not a custom base density being entered.
CUSTOM_NAME	38.3	*RW	OOS		NULL	Name of the custom fluid entered. If type is not custom, then nothing will be shown on a read. Writable if type fluid is set to custom.

-Continued-

Table B-54. Primary Transducer Block Parameter Definitions (Continued)

Label PARAMETER_NAME	Index Number	RO / RW	Mode	Range	Initial Value	Description
Lower Density LOWER_DENSITY	39					Data Type: DS-65 Lower fluid density.
STATUS	39.1	RO	NA	NA	NA	Data Type: Uint8 Status of lower fluid density value
VALUE	39.2	RO	NA	NA	NA	Data Type: Float Lower fluid density value
LOWER_TBL	40					Data Type: DS-257 Density correction table for lower fluid. When LOWER_FLUID_ TYPE.TYPE is set to custom, this parameter becomes RW.
COMP_TEMP_1	40.1	*RW	OOS	146 to 699 K	288.706K	Data Type: FloatData Type: Float
LOWER_DENSITY_	40.2	*RW	OOS	> 0	1	
COMP_TEMP_2	40.3	*RW	OOS	146 to 699 K	310.928K	Data Type: FloatData Type: Float
LOWER_DENSITY_2	40.4	*RW	OOS	> 0	0.994	
COMP_TEMP_3	40.4	*RW	OOS	146 to 699 K	366.483K	Data Type: FloatData Type: Float
LOWER_DENSITY_3	40.5	*RW	OOS	> 0	0.964	
COMP_TEMP_4	40.6	*RW	OOS	146 to 699 K	422.039K	
LOWER_DENSITY_4	40.7	*RW	OOS	> 0	0.919	
COMP_TEMP_5	40.8	*RW	OOS	146 to 699 K	477.594K	
LOWER_DENSITY_5	40.9	*RW	OOS	> 0	0.86	
COMP_TEMP_6	40.10	*RW	OOS	146 to 699 K	533.15K	Data Type: FloatData Type: Float
LOWER_DENSITY_6	40.11	*RW	OOS	> 0	0.786	
COMP_TEMP_7	40.12	*RW	OOS	146 to 699 K	588.706K	Data Type: FloatData Type: Float
LOWER_DENSITY_7	40.13	*RW	OOS	> 0	0.679	
COMP_TEMP_8	40.14	*RW	OOS	146 to 699 K	0	
LOWER_DENSITY_8	40.15	*RW	OOS	> 0	0	Data Type: FloatData Type: Float
COMP_TEMP_9	40.16	*RW	OOS	146 to 699 K	0	
LOWER_DENSITY_9	40.17	*RW	OOS	> 0	0	
COMP_TEMP_10	40.18	*RW	OOS	146 to 699 K	0	
LOWER_DENSITY_10	40.19	*RW	OOS	> 0	0	
Electronics Temperature ELECTRONICS_TEMP	41	RO	NA	NA	NA	Data Type: Float Current electronics temperature
SNAP_ACTING_CTRL	42	RW	OOS	0: Off 1: On	0: Off	Data Type: Enum (1) Turns SNAP controller on or off
SNAP_UNITS	43	RW	OOS	1010: Meter 1012: cm 1013: mm 1018: ft. 1019: in. 1342: Percent	1342: percent	Data Type: Enum (2) Units all the SNAP parameters are in.

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Table B-54. Primary Transducer Block Parameter Definitions (Continued)

Label PARAMETER_NAME	Index Number	RO / RW	Mode	Range	Initial Value	Description
DI_1_TRIP_PT	44	RW	OOS	NA	100%	Data Type: Float Point where DI_1 will trip based on PRIMARY_VALUE_RANGE
DI_1_DEADBAND	45	RW	OOS	< 99.5%, > 0%	1%	Data Type: Float Deadband where a tripped DI_1 will reset.
DI_1_ACTION	46	RW	OOS	0: Trip on falling level 1: Trip on rising level	1: Trip on rising level	Data Type: Enum (1) D_1 trips on rising or falling level
DI_1_READBACK	47					Data Type: DS-66 Output of DI_1
STATUS	47.1	RO	NA	NA	NA	Data Type: Uint8
VALUE	47.2	RO	NA	NA	NA	Data Type: Uint8
DI_2_TRIP_PT	48	RW	OOS	NA	0%	Data Type: Float Point where DI_2 will trip based on PRIMARY_VALUE_RANGE. Range is within Primary Sensor Range
DI_2_DEADBAND	49	RW	OOS	< 99.5%, > 0%	1%	Data Type: Float Deadband where a tripped DI_2 will reset.
DI_2_ACTION	50	RW	OOS	0:Trip on falling level 1: Trip on rising level	0: Trip on falling level	Data Type: Enum (1) D_2 trips on rising or falling level
DI_2_READBACK	51					Data Type: DS-66 Output of DI_2
STATUS	51.1	RO	NA	NA	NA	Data Type: Uint8
VALUE	51.2	RO	NA	NA	NA	Data Type: Uint8
SENSOR_MAJOR_REV	52	RO	NA	NA	NA	Data Type: Uint8 Major firmware revision of sensor board.
SENSOR_MINOR_REV	53	RO	NA	NA	NA	Data Type: Uint8 Minor firmware revision of sensor board.
INSTRUMENT_SN	54	RW	OOS	NA	NULL	Data Type: Visible String [16] Digital level controller serial number (appears on nameplate).
SENSOR_ELECT_ID	55	RO	NA	NA	NA	Data Type: Visible String [16] Unique string identifying the sensor electronics characterization and test record in the manufacturing test data base.
TB_DETAILED_STATUS	56	RO		Bit 23 - 1	NA	Data Type: BIT_ENUM (4) Parameter used to show in detail what alerts are currently set.
Recommended Action RECOMMENDED_ACTION	57	RO	NA	NA	NA	Data Type: Uint16 Fix for most serious condition
Failed Priority FAILED_PRI	58	RW	AUTO	0 to 15	2	Data Type: Uint8 Failed alert priority
Failed Enable FAILED_ENABLE	59	RW	AUTO	1: 2: 3: 4: 5: 6: 7: 8:	1: 5:	Data Type: BIT_ENUM (4) Failed alert enable. Enable allows detection of alert. All alerts can be disabled.
Failed Suppress FAILED_MASK	60	RW	AUTO	1: 2: 3: 4: 5: 6: 7: 8:	All 0	Data Type: BIT_ENUM (4) Failed alert mask. MASK controls whether an alert is reported. If alert is enabled the alert condition is evaluated and the ACTIVE parameter is updated reflect if alert is active or not. If the bit is set reporting is suppressed.

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Table B-54. Primary Transducer Block Parameter Definitions (Continued)

Label PARAMETER_NAME	Index Number	RO / RW	Mode	Range	Initial Value	Description
Failed Active FAILED_ACTIVE	61	*RO		1: 2: 3: 4: 5: 6: 7: 8:	All 0	Data Type: BIT_ENUM (4) Failed Alert Status 0 = inactive, 1 = active *RW when Simulate jumper and PWA_SIMULATE is set to 2
Failed Alarm FAILED_ALM	62					Data Type: DS-71 Used to report alerts to host system.
UNACKNOWLEDGED	62.1	RW		0: Undefined 1: Acknowledged 2: Unacknowledged		
ALARM_STATE	62.2	RO	NA	0: Undefined 1: Clear (reported) 2: Clear (not reported) 3: Active (reported) 4: Active (not reported)		
TIME_STAMP	62.3	RO	NA	NA		
SUBCODE	62.4	RO	NA	NA		
VALUE	62.5	RO	NA	NA		Data Type: Float Value of parameter at alarm time for single alarm, 0 for multiple alarms
Maintenance Priority MAINT_PRI	63	RW	AUTO	0 to 15	2	Data Type: Uint8 Maintenance alert priority
Maintenance Enable MAINT_ENABLE	64	RW	AUTO	1: 2: 3: 4: 5: 6: 7: 8:	Bit 4	Data Type: BIT_ENUM (4) Maintenance alert enable. Enable allows detection of alert. All alerts can be disabled.
Maintenance Suppress MAINT_MASK	65	RW	AUTO	1: 2: 3: 4: 5: 6: 7: 8:	All 0	Data Type: BIT_ENUM (4) Maintenance alert mask. MASK controls whether an alert is reported. If alert is enabled the alert condition is evaluated and the ACTIVE parameter is updated reflect if alert is active or not. If the bit is set reporting is suppressed.
Maintenance Active MAINT_ACTIVE	66	*RO		1: 2: 3: 4: 5: 6: 7: 8:	All 0	Data Type: BIT_ENUM (4) Maintenance Alert Status 0 = inactive, 1 = active
Maintenance Alarm MAINT_ALM	67					Data Type: DS-71 Used to report alerts to host system.
UNACKNOWLEDGED	67.1	RW	AUTO	0: Undefined 1: Acknowledged 2: Unacknowledged		
ALARM_STATE	67.2	RO	NA	0: Undefined 1: Clear (reported) 2: Clear (not reported) 3: Active (reported) 4: Active (not reported)		

-Continued-

Table B-54. Primary Transducer Block Parameter Definitions (Continued)

Label PARAMETER_NAME	Index Number	RO / RW	Mode	Range	Initial Value	Description
TIME_STAMP	67.3	RO	NA	NA		
SUBCODE	67.4	RO	NA	NA		
VALUE	67.5	RO	NA	NA		Data Type: Float Value of parameter at alarm time for single alarm, 0 for multiple alarms
Advise Priority ADVISE_PRI	68	RW	AUTO	0 to 15	2	Data Type: Uint8 Advise alert priority
Advice Enable ADVISE_ENABLE	69	RW	AUTO	1: 2: 3: 4: 5: 6: 7: 8:	2: 3: 6: 7: 8:	Data Type: BIT_ENUM (4) Advise alert enable. Enable allows detection of alert. All alerts can be disabled.
Advise Suppress ADVISE_MASK	70	RW	AUTO	1: 2: 3: 4: 5: 6: 7: 8:	All 0	Data Type: BIT_ENUM (4) Advise alert mask. MASK controls whether an alert is reported. If alert is enabled the alert condition is evaluated and the ACTIVE parameter is updated reflect if alert is active or not. If the bit is set reporting is suppressed.
Advise Active ADVISE_ACTIVE	71	*RO		1: 2: 3: 4: 5: 6: 7: 8:	All 0	Data Type: BIT_ENUM (4) Advise Alert Status 0 = inactive, 1 = active
Advise Alarm ADVISE_ALM	72					Data Type: DS-71 Used to report alerts to host system.
UNACKNOWLEDGED	72.1	RW	AUTO	0: Undefined 1: Acknowledged 2: Unacknowledged	0	
ALARM_STATE	72.2	RO	NA	0: Undefined 1: Clear (reported) 2: Clear (not reported) 3: Active (reported) 4: Active (not reported)	0	
TIME_STAMP	72.3	RO	NA	NA	0	
SUBCODE	72.4	RO	NA	NA	0	
VALUE	72.5	RO	NA	NA	0	Data Type: Float Value of parameter at alarm time for single alarm, 0 for multiple alarms
HEALTH_INDEX	73	RO	NA	0 to 100	100	Data Type: Uint8 Represents overall health of device. 10% - Failed Alert is active, 60% - Maintenance Alert is active, 90% - Advisory Alert is active, 100% no alerts are active.
PWA_SIMULATE	74	*RO	AUTO	1: Simulate Off 2: Simulate Enabled	1: Simulation off	Data Type: Enum (1) When this is set to 2 all the alert ACTIVE parameters can be written, except for DETAILED_STATUS. This allows alerts to be simulated for testing with hosts. *RW when simulate jumper is jumpered
RAPID_RATE_LIMIT	75	RW	AUTO	Lower limit: 1% of displacer length. Upper limit: displacer length.	1.778 cm	The maximum amount of fall/rise in level before the rapid fall/rise alerts activate per second.

-Continued-

Table B-54. Primary Transducer Block Parameter Definitions (Continued)

Label PARAMETER_NAME	Index Number	RO / RW	Mode	Range	Initial Value	Description
PRESSURE_SELECT	76	RW	OOS	1: None 2: Manual 3: AO	0: None	
COMP_PRESSURE	77	RW			NA	Data Type: DS-65 Pressure of upper fluid when upper fluid is a gas and can effect level measurement.
STATUS	77.1	RO		NA	NA	Data Type: Uint8
VALUE	77.2	RW	OOS	NA	NA	Data Type: Float Compensation pressure. Writable if PRESSURE_SELECT is set to manual.
GAS_MOL_WGT	78	RW	OOS	> 0	NA	Data Type: Float Molecular weight of gas
DEVICE_HISTORY	79					Data Type: DS-266
MAX_RECORDED_TEMP	79.1	RO	NA	-	NA	Data Type: Float Maximum temperature the device has experienced.
MIN_RECORDED_TEMP	79.2	RO	NA	-	NA	Data Type: Float Minimum temperature the device has experience
TIME_OVER_UTL	79.3	RO	NA	-	NA	Data Type: Float Total number of days the device has been over 80 C
TIME_UNDER_LTL	79.4	RO	NA	-	NA	Data Type: Float Total number of days the device has been under -40 C
TEMP_INTEGRAL	79.5	RO	NA	-	NA	Data Type: Float The running integral of temperature - time in DLC_UNITS. TEMPERATURE * day
RUN_TIME	79.6	RO	NA	-	NA	Data Type: Float The number of days the device has been running.
TIME_SINCE_RESET	79.7	RO	NA	-	0	Data Type: Float Number of days since the last time the DLC3020f was restarted.
CHAR_ARRAY	80	RW	AUTO	-	-	Data Type: Uint8 Array[80] Reserved
INT_ARRAY	81	RW	AUTO	-	-	Data Type: Uint16 Array[20] Reserved
LONG_ARRAY	82	RW	AUTO	-	-	Data Type: Uint32 Array[10] Reserved
FLOAT_ARRAY	83	RW	AUTO	-	-	Data Type: Float Array [21] Reserved
STRING_RESERVED	84	RW	AUTO	-	-	Data Type: Visible String[16] Reserved
RESERVED	85	RW	AUTO	-	-	Data Type: Uint16 Reserved

View Lists

View lists allow the values of a set of parameters to be accessed at the same time. Views 1 and 2 contain operating parameters and are defined by the Fieldbus Foundation. View 3 contains dynamic parameters and View 4 contains static parameters with configuration and maintenance information. Views 3 and 4 are defined by the manufacturer.

Table B-55. Primary Transducer Block, View 1

Index Number	Parameter
1	ST_REV
5.1	MODE_BLK.TARGET_MODE
5.2	MODE_BLK.ACTUAL_MODE
5.3	MODE_BLK.PERMITTED_MODE
5.4	MODE_BLK.NORMAL_MODE
6	BLOCK_ERR
10	TRANSDUCER_TYPE
11	XD_ERROR
14.1	PRIMARY_VALUE.STATUS
14.2	PRIMARY_VALUE.TYPE
28.1	PV_PERCENT.STATUS
28.2	PV_PERCENT.VALUE

Table B-56. Primary Transducer Block, View 2

Index Number	Parameter
1	ST_REV
10	TRANSDUCER TYPE
13	PRIMARY_VALUE_TYPE

Table B-57. Primary Transducer Block, View 3

Index Number	Parameter
1	ST_REV
5.1	MODE_BLK.TARGET_MODE
5.2	MODE_BLK.ACTUAL_MODE
5.3	MODE_BLK.PERMITTED_MODE
5.4	MODE_BLK.NORMAL_MODE
6	BLOCK_ERR
10	TRANSDUCER_TYPE
11	XD_ERROR
14.1	PRIMARY_VALUE.STATUS
14.2	PRIMARY_VALUE.TYPE
17.1	SENSOR_RANGE.EU_100
17.2	SENSOR_RANGE.EU_0
17.3	SENSOR_RANGE.ENG_UNITS
17.4	SENSOR_RANGE.DECIMAL
28.1	PV_PERCENT.STATUS
28.2	PV_PERCENT.VALUE
31.1	COMP_TEMPERATURE.STATUS
31.2	COMP_TEMPERATURE.VALUE
34.1	TORQUE_TUBE_COMP.STATUS
34.2	TORQUE_TUBE_COMP.VALUE
36.1	UPPER_DENSITY.STATUS
36.2	UPPER_DENSITY.VALUE
39.1	LOWER_DENSITY.STATUS
39.2	LOWER_DENSITY.VALUE
41	ELECTRONICS_TEMP
47.1	DI_1_READBACK.STATUS
47.2	DI_1_READBACK.VALUE
51.1	DI_2_READBACK.STATUS
51.2	DI_2_READBACK.VALUE
56	TB_DETAILED_STATUS
57	RECOMMENDED_ACTION
61	FAILED_ACTIVE
66	MAINT_ACTIVE
71	ADVISE_ACTIVE
73	HEALTH_INDEX
74	PWA_SIMULATE
77.1	COMP_PRESSURE.STATUS
77.2	COMP_PRESSURE.VALUE
79.1	DEVICE_HISTORY.MAX_RECORDED_TEMP
79.2	DEVICE_HISTORY.MIN_RECORDED_TEMP
79.3	DEVICE_HISTORY.TIME_OVER_UTL
79.4	DEVICE_HISTORY.TIME_UNDER_LTL
79.5	DEVICE_HISTORY.TEMP_INTEGRAL
79.6	DEVICE_HISTORY.RUN_TIME
79.7	DEVICE_HISTORY.TIME_SINCE_RESET

Note
Because individual views are limited in size, View List 4 has four parts.

Table B-58. Primary Transducer Block, View 4.1

Index Number	Parameter
1	ST_REV
3	STRATEGY
4	ALERT_KEY
10	TRANSDUCER_TYPE
18	SENSOR_SN
19	SENSOR_CAL_METHOD
20	SENSOR_CAL_LOC
21	SENSOR_CAL_DATE
22	SENSOR_CAL_WHO

Table B-59. Primary Transducer Block, View 4.2

Index Number	Parameter
1	ST_REV
15.1	PRIMARY_VALUE_RANGE.EU_100
15.2	PRIMARY_VALUE_RANGE.EU_0
15.3	PRIMARY_VALUE_RANGE.ENG_UNITS
15.4	PRIMARY_VALUE_RANGE.DECIMAL
16	SENSOR_TYPE
24.1	SENSOR_INFO.SENSR_TYPE
24.2	SENSOR_INFO.END_CONNECTION_STYLE
24.3	SENSOR_INFO.TT_WALL
24.4	SENSOR_INFO.PRESSURE_RATING
24.5	SENSOR_INFO.END_CONNECTION_TYPE
24.6	SENSOR_INFO.DISPLACER_SIZE
24.7	SENSOR_INFO.DISPLACER_MTL
24.8	SENSOR_INFO.DISPLACER_RATING
24.9	SENSOR_INFO.G_DIMEN
24.10	SENSOR_INFO.BODY_MTL
24.11	SENSOR_INFO.MECHANICAL_SENSOR_SN
24.12	SENSOR_INFO.HEAT_INSULATOR
24.13	SENSOR_INFO.TT_MATERIAL
25.1	DLC_UNITS.UNIT_SYSTEM
25.2	DLC_UNITS.LENGTH_UNITS
25.3	DLC_UNITS.VOLUME_UNITS
25.4	DLC_UNITS.WEIGHT_UNITS
25.5	DLC_UNITS.TEMPERATURE_UNITS
25.6	DLC_UNITS.DENSITY_UNITS
25.7	DLC_UNITS.TORQUE_RATE_UNITS
25.8	DLC_UNITS.PRESSURE_UNITS
26.1	DLC_SENSOR_PARAM.DISPLACER_LENGTH
26.2	DLC_SENSOR_PARAM.DISPLACER_VOLUME
26.3	DLC_SENSOR_PARAM.DISPLACER_WEIGHT
26.4	DLC_SENSOR_PARAM.DRIVER_ROD_LENGTH
24	MOUNT_POSITION

Table B-60. Primary Transducer Block, View 4.3

Index Number	Parameter
1	ST_REV
29	PV_OFFSET
30	TEMP_COMP_SELECT
32	TORQUE_TUBE_MTL
42	SNAP_ACTING_CTRL
43	SNAP_UNITS
44	DI_1_TRIP_PT
45	DI_1_DEADBAND
46	DI_1_ACTION
48	DI_2_TRIP_PT
49	DI_2_DEADBAND
50	DI_2_ACTION
52	SENSOR_MAJOR_REV
53	SENSOR_MINOR_REV
54	INSTRUMENT_SN
55	SENSOR_ELECT_ID
58	FAILED_PRI
59	FAILED_ENABLE
60	FAILED_MASK
63	MAINT_PRI
64	MAINT_ENABLE
65	MAINT_MASK
68	ADVISE_PRI
69	ADVISE_ENABLE
70	ADVISE_MASK
75	RAPID_RATE_LIMIT
76	PRESSURE_SELECT
78	GAS_MOL_WGT

Table B-61. Primary Transducer Block, View 4.4

Index Number	Parameter
1	ST_REV
35.1	UPPER_FLUID_TYPE.TYPE
35.2	UPPER_FLUID_TYPE.BASE_DENSITY
35.3	UPPER_FLUID_TYPE.CUSTOM_NAME
38.1	LOWER_FLUID_TYPE.TYPE
38.2	LOWER_FLUID_TYPE.BASE_DENSITY
38.3	LOWER_FLUID_TYPE.CUSTOM_NAME

Transducer Block (LCD)

The LCD transducer block is used to configure DLC3020f display properties. It has no affect on the reported PV.

LCD Transducer Block Parameters

- Read/Write Capability: RO - Read Only, RW - Read Write
- Mode: The block mode(s) required to write to the parameter
- Double indentation and shaded Index Number indicates sub-parameter

Table B-62. LCD Transducer Block Parameter Definitions

Label PARAMETER_NAME	Index Number	RO / RW	Range	Default Value	Description
Static Revision ST_REV	1	RO	0 to 65535	0	Data Type: Uint16 The revision level of the static data. Increments by one each time a static parameter is written. The value is reset to 0 whenever a Restart with Defaults is performed.
Tag Description TAG_DESC	2	RW		NULL	Data Type: String The description of the block.
Strategy STRATEGY	3	RW	0 to 65535	0	Data Type: Uint16 Used to help group blocks.
Alert Key ALERT_KEY	4	RW		0	Data Type: Uint8 The identification number of the plant unit. Devices in a loop or plant section can be assigned with a common alert key to aid the operator in determining location of alerts.
Block Mode MODE_BLK	5				Data Type: DS-69 The actual, target, permitted, and normal modes. Target: The requested block mode Actual: The current mode of the block Permitted: Allowed modes for Target Normal: Most common mode for Target
TARGET	5.1	RW	3: AUTO 7: OOS	7: OOS	
ACTUAL	5.2	RO		NA	
PERMITTED	5.3	RW		3:AUTO 7: OOS	
NORMAL	5.4	RW		3:AUTO	
Block Error BLOCK_ERR	6	RO	Bit 15		Data Type: Bit String Error status associated with hardware or firmware for the transducer block.
Display Mode DISPLAY_MODE	7	RW	1: PV Only 2: % Range 3: PV / % Range	1	Data Type: Enum (1) Mode the LCD is in.
LCD Unit System LCD_UNIT_SYSTEM	8	RO	1: English 2: Metric 3: Mixed	2: Metric	Data Type: Enum (1) The unit system used for the device.
DISPLAY_PV_UNITS	9	RW	1010: Meter 1012: cm 1013: mm 1018: ft. 1019: in. 1342: Percent	1012: cm	Data Type: Enum (2) PV_DISPLAY units.
DECIMAL_PLACES	10	RW	0: No decimals 1: One 2: Two 3: Three 4: Four 5: As many decimal places as possible	2	Data Type: Uint8 Ideal decimal places shown. It could be less if decimal places need to be sacrificed to display digits left of the decimal point. If that becomes a problem, consider changing display units.
DISPLAY_OFFSET	11	RW	NA	0	Data Type: Float PV offset applied to display

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Table B-62. LCD Transducer Block Parameter Definitions (Continued)

Label PARAMETER_NAME	Index Number	RO / RW	Range	Default Value	Description
DISPLAY_PV	12				Data Type: DS-65
VALUE	12.1	*RO	NA	NA	Data Type: Float PV in units selected above including display offset if it applies. *If LCD_TEST is set to 2 - Manual Test and LCD Transducer block is in OOS, then parameter becomes RW and user can manually write value (does not affect actual PV value)
STATUS	12.2	RO	NA	NA	Data Type: Uint8 Status of DISPLAY_PV.VALUE
DISPLAY_PV_PRCNT	13				Data Type: DS-65
VALUE	13.1	*RO	NA	NA	Data Type: Float PV in percent. *If LCD_TEST is set to 2 - Manual Test and LCD Transducer block is in OOS, then parameter becomes RW and user can manually write value (does not affect actual PV value)
STATUS	13.3	RO	NA	NA	Data Type: Uint8 Status of DISPLAY_PV_ PERCENT.VALUE
DISPLAY_MESSAGES	14	RW	0: Display PV Bad 1: Display PV Uncertain 2: Display Failed Alert 3: Display Maint Alert 4: Display Advisory Alert	Bit 0 - 2	Data Type: Bit String Allows individual messages to be turned on or off.
LCD TEST	15	*RW	0: No test 1: Run test 2: Manual test	0: No test	Data Type: Enum (1) *RW only when OOS

View Lists

View lists allow the values of a set of parameters to be accessed at the same time. Views 1 and 2 contain operating parameters and are defined by the Fieldbus Foundation. View 3 contains dynamic parameters and View 4 contains static parameters with configuration and maintenance information. Views 3 and 4 are defined by the manufacturer.

Table B-63. LCD Transducer Block, View 1

Index Number	Parameter
1	ST_REV
5.1	MODE_BLK.TARGET_MODE
5.2	MODE_BLK.ACTUAL_MODE
5.3	MODE_BLK.PERMITTED_MODE
5.4	MODE_BLK.NORMAL_MODE
6	BLOCK_ERR
12.1	DISPLAY_PV.VALUE
12.2	DISPLAY_PV.STATUS
13.1	DISPLAY_PV_PRCNT.VALUE
13.2	DISPLAY_PV_PRCNT.STATUS

Table B-64. LCD Transducer Block, View 2

Index Number	Parameter
1	ST_REV

Table B-65. LCD Transducer Block, View 3

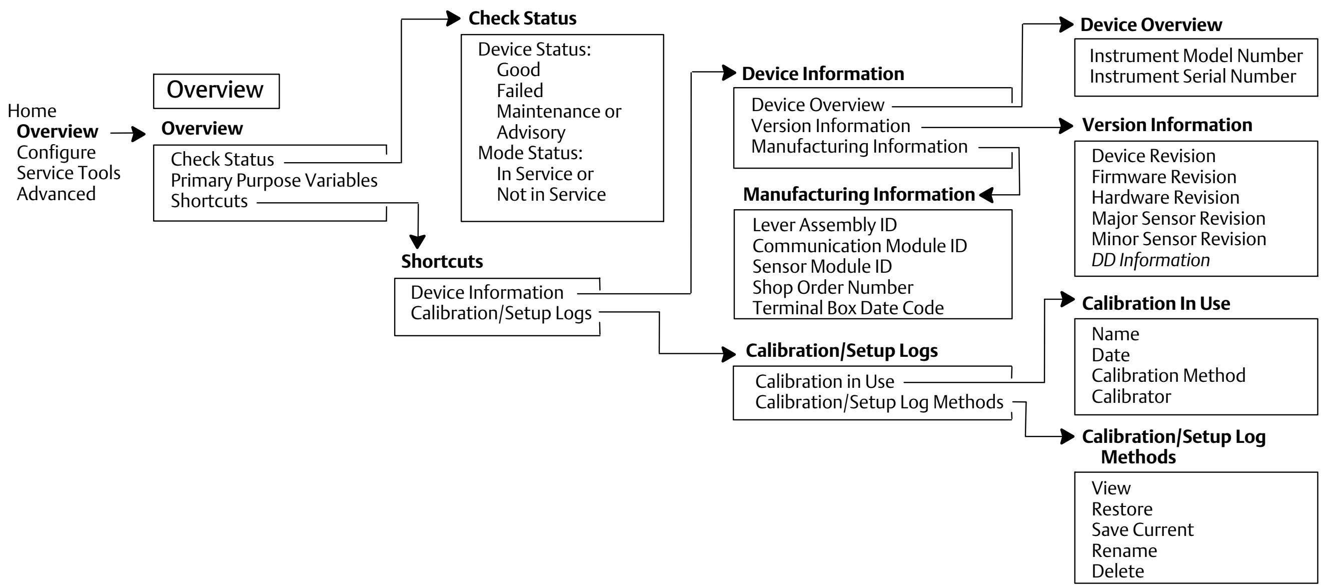
Index Number	Parameter
1	ST_REV
12.1	DISPLAY_PV.VALUE
12.2	DISPLAY_PV.STATUS
13.1	DISPLAY_PV_PRCNT.VALUE
13.2	DISPLAY_PV_PRCNT.STATUS

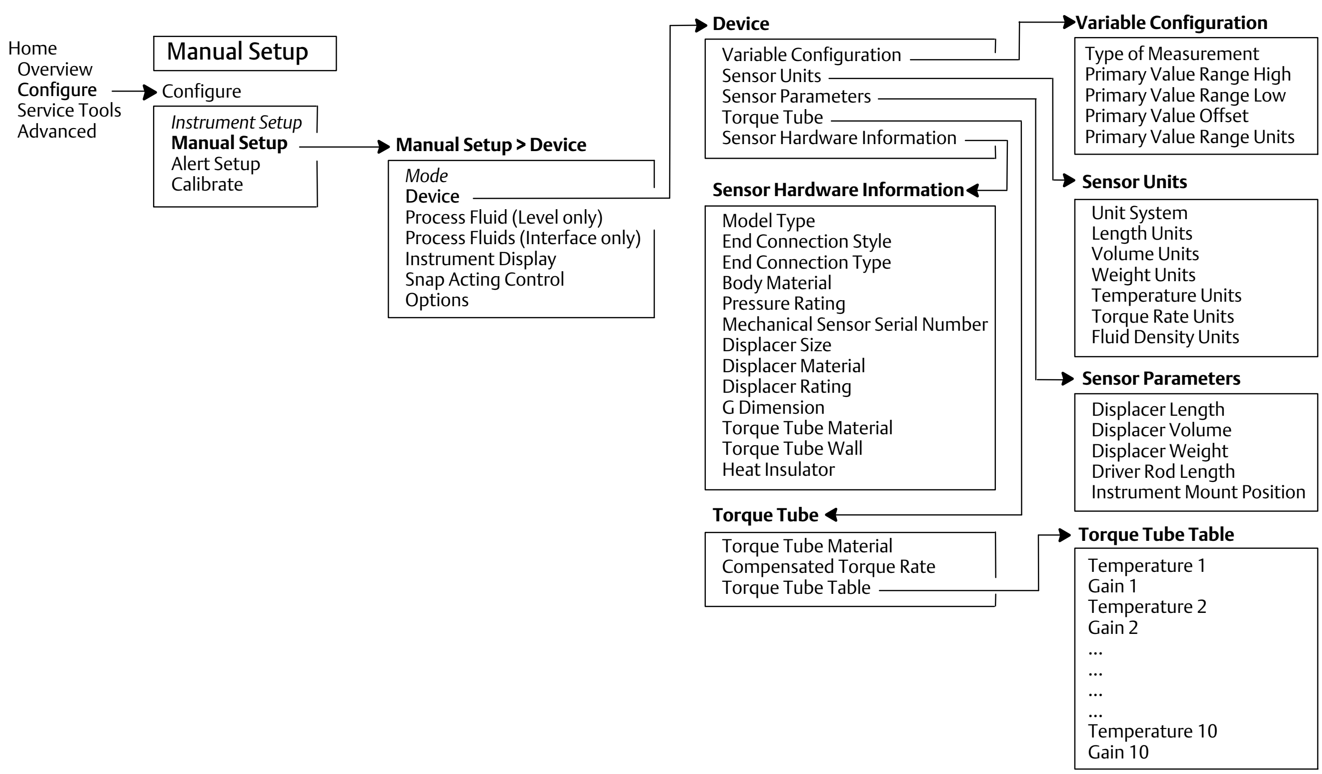
Table B-66. LCD Transducer Block, View 4

Index Number	Parameter
1	ST_REV
3	STRATEGY
4	ALERT_KEY
7	DISPLAY_MODE
8	LCD_UNIT_SYSTEM
9	DISPLAY_PV_UNITS
10	DECIMAL_PLACES
11	DISPLAY_OFFSET
14	DISPLAY_MESSAGES
15	LCD_TEST

Field Communicator Menu Tree (Resource and Transducer Blocks)

Bold Italic text = Method





Bold Italic text = Method

Manual Setup (continued)

Manual Setup > Process Fluid (Level only)

Mode
Device
Process Fluid (Level only)
Process Fluids (Interface only)
Instrument Display
Snap Acting Control
Options

Process Fluid (Level only)

Process Fluid
Change Process Fluid
Temperature Compensation
Density Table

Process Fluid

Fluid Name
Density in Use

Temperature Compensation

Temperature Input
Temperature For Compensation
(Visible if Temperature Input = None only

Density Table

Temperature 1
Density 1
Temperature 2
Density 2
....
....
....
....
Temperature 10
Density 10

Manual Setup > Process Fluid (Interface only)

Mode
Device
Process Fluid (Level only)
Process Fluids (Interface only)
Instrument Display
Snap Acting Control
Options

Process Fluids (Interface only)

Upper Fluid
Lower Fluid
Change Process Fluid
Temperature Compensation
Density Tables

Upper Fluid

Fluid Name
Density in Use

Lower Fluid

Fluid Name
Density in Use

Temperature Compensation

Temperature Input
Temperature For Compensation
(Visible if Temperature Input = None only)

Density Tables

Upper Fluid Density Table
Lower Fluid Density Table

Lower Fluid Density Table

Temperature 1
Density 1
Temperature 2
Density 2
...
...
...
...
Temperature 10
Density 10

Upper Fluid Density Table

Temperature 1
Density 1
Temperature 2
Density 2
...
...
...
...
Temperature 10
Density 10

Manual Setup > Instrument Display

Mode
Device
Process Fluid (Level)
Process Fluids (Interface)
Instrument Display
Snap Acting Control
Options

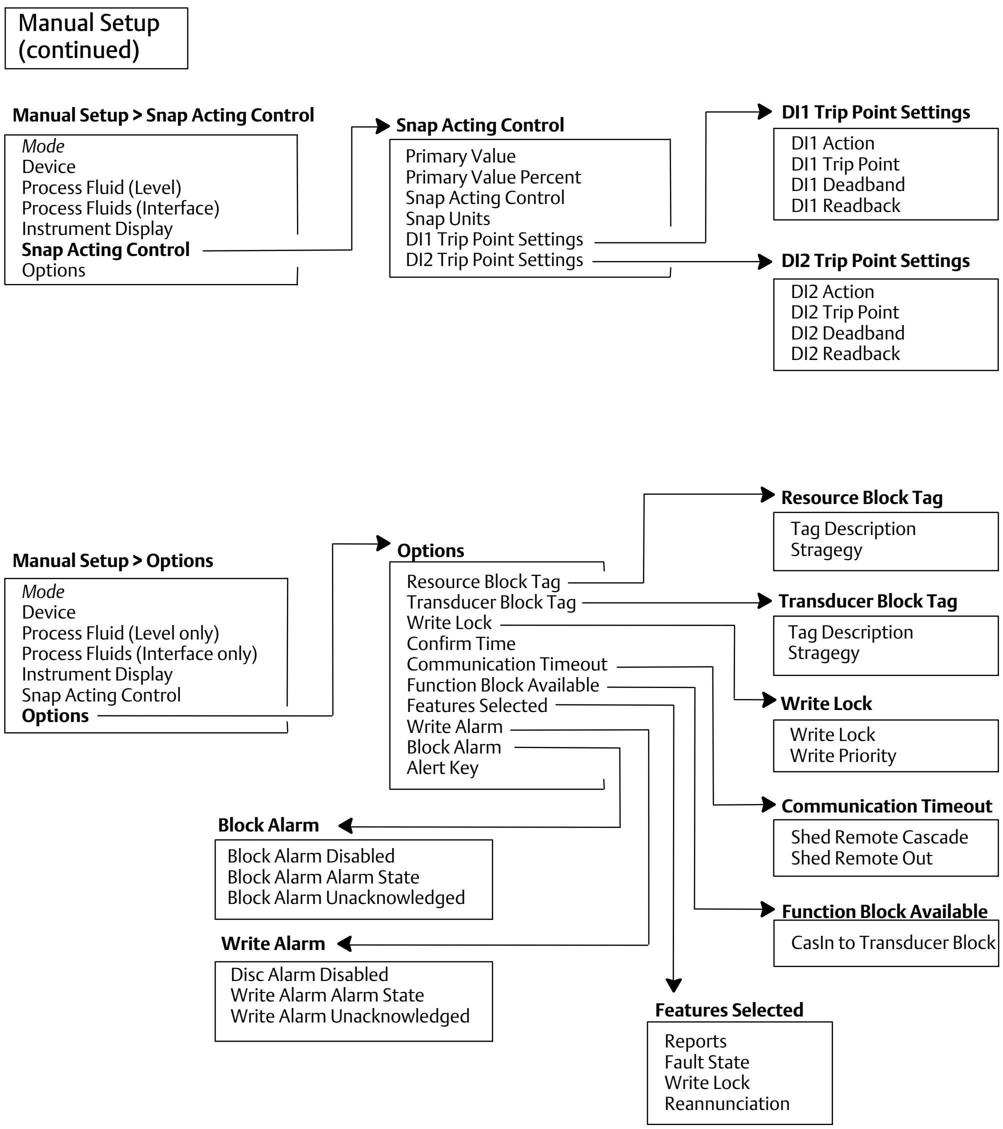
Instrument Display

Display Option
Device Display Primary Value Units
Decimal Places
Display Primary Value Offset
Scroll Message Control

Scroll Message Control

Primary Value Bad
Primary Value Uncertain
Failed Alert
Maintenance Alert
Advisory Alert

Bold Italic text = Method



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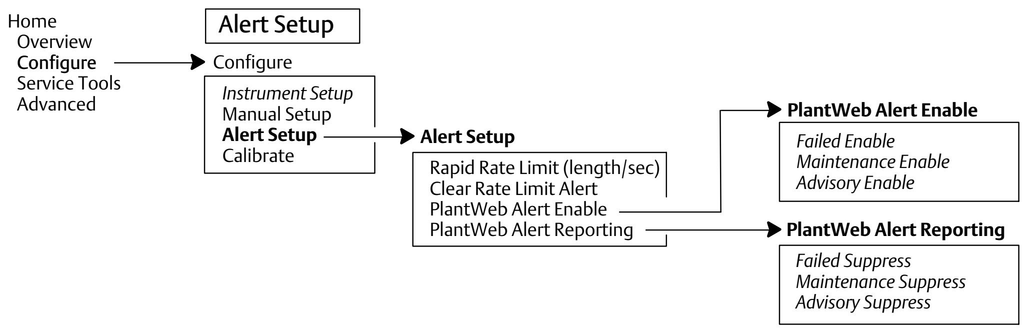
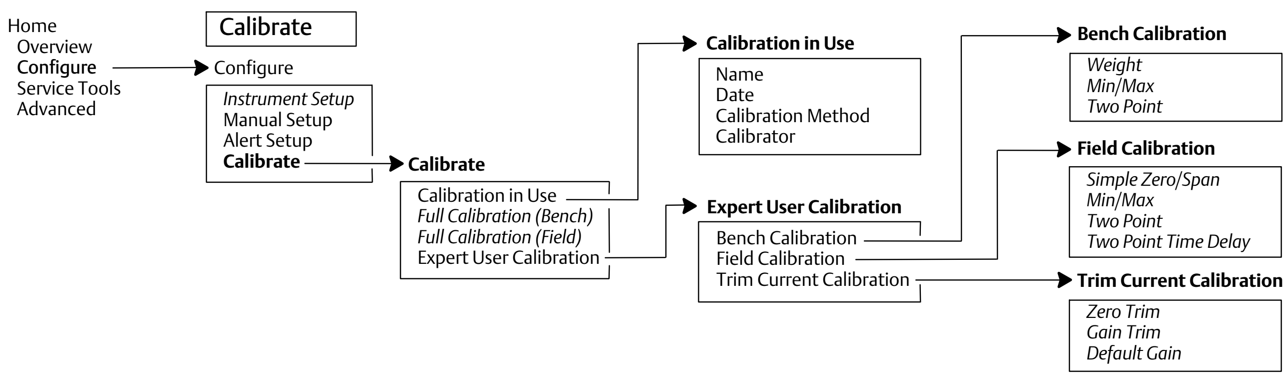
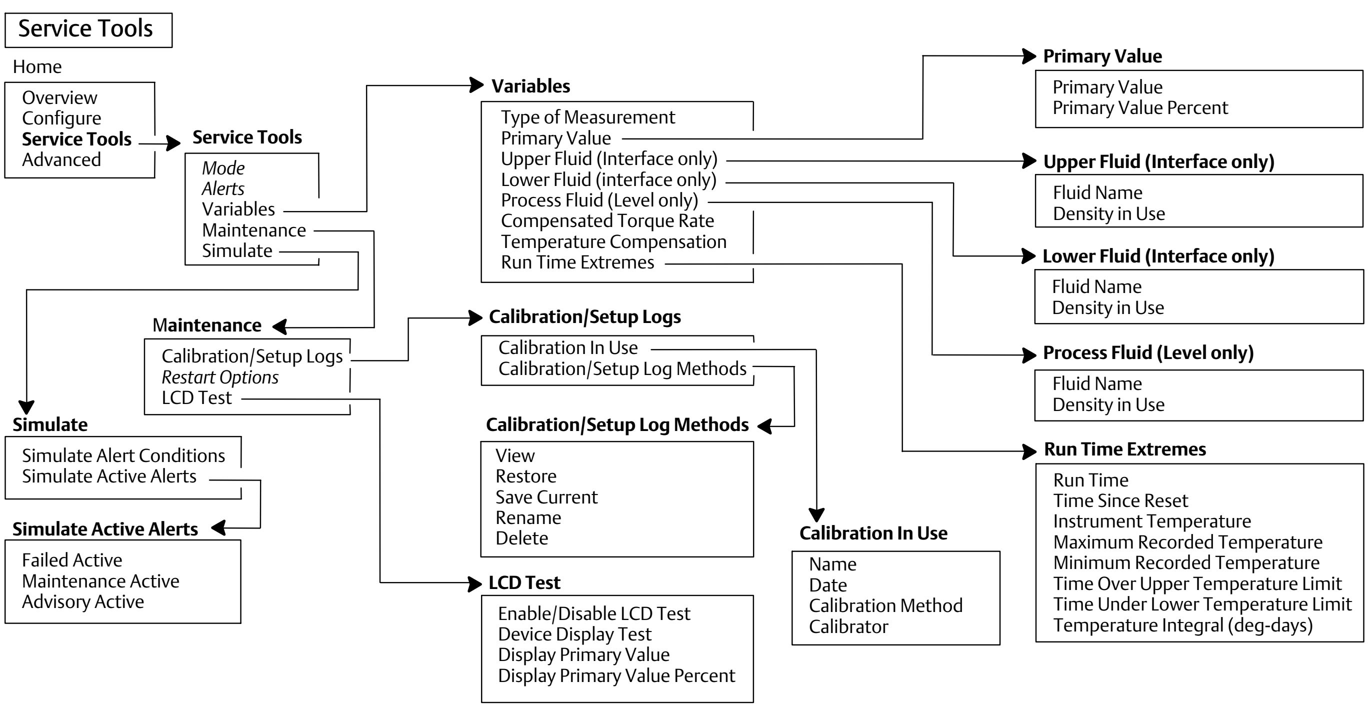






Appendix C FOUNDATION fieldbus Communication

FOUNDATION Fieldbus Communication

DLC3020f digital level controllers use the FOUNDATION fieldbus to communicate with other fieldbus instruments and the control system. Fieldbus is an all digital, serial, two-way communication system which interconnects “field” equipment such as transmitters, digital level controllers, and process controllers. Fieldbus is a local-area network (LAN) for instruments used in both process and manufacturing automation with built-in capability to distribute the control application across the network.

Function Block Overview

A fieldbus system is a distributed system composed of field devices and control and monitoring equipment integrated into the physical environment of a plant or factory. Fieldbus devices work together to provide I/O and control for automated processes and operations. The Fieldbus Foundation provides a framework for describing these systems as a collection of physical devices interconnected by a fieldbus network. One of the ways that the physical devices are used is to perform their portion of the total system operation by implementing one or more function blocks.

Function Blocks

Function blocks within the fieldbus device perform the various functions required for process control. Because each system is different, the mix and configuration of functions are different. Therefore, the Fieldbus Foundation has designed a range of function blocks, each addressing a different need: Analog Input Block (AI), Multiple Analog Input (MAI), Discrete Input Block (DI), Manual Loader Block (ML), Bias/Gain Station Block (BG), Control Selector Block (CS), P, PD Controller Block (PD), PID, PI, I Controller Block (PID), Ratio Station Block (RA), Analog Output Block (AO) and Discrete Output Block (DO).

Function blocks perform process control functions, such as analog input (AI) and analog output (AO) functions as well as proportional-integral-derivative (PID) functions. The standard function blocks provide a common structure for defining function block inputs, outputs, control parameters, events, alarms, and modes, and combining them into a process that can be implemented within a single device or over the fieldbus network. This simplifies the identification of characteristics that are common to function blocks.

The Fieldbus Foundation has established the function blocks by defining a set of parameters used in all function blocks called universal parameters. The Fieldbus Foundation has also defined a standard set of function block classes, such as input, output, control, and calculation blocks. Each of these classes have a set of parameters established for it. Additionally, they have published definitions for transducer blocks commonly used with standard function blocks. Examples include temperature, pressure, level, and flow transducer blocks.

Fieldbus Foundation specifications and definitions allow vendors to add their own, extended parameters, as well as their own algorithms. This approach permits extending function block definitions as new requirements are discovered and as technology advances.

Each block has a tag name. Service personnel need only know the tag name of the block to access or change the appropriate block parameters.

Input events may affect the operation of the algorithm. An execution control function regulates the receipt of input events and the generation of output events during execution of the algorithm. Upon completion of the algorithm, the data internal to the block is saved for use in the next execution, and the output data is snapped, releasing it for use by other function blocks.

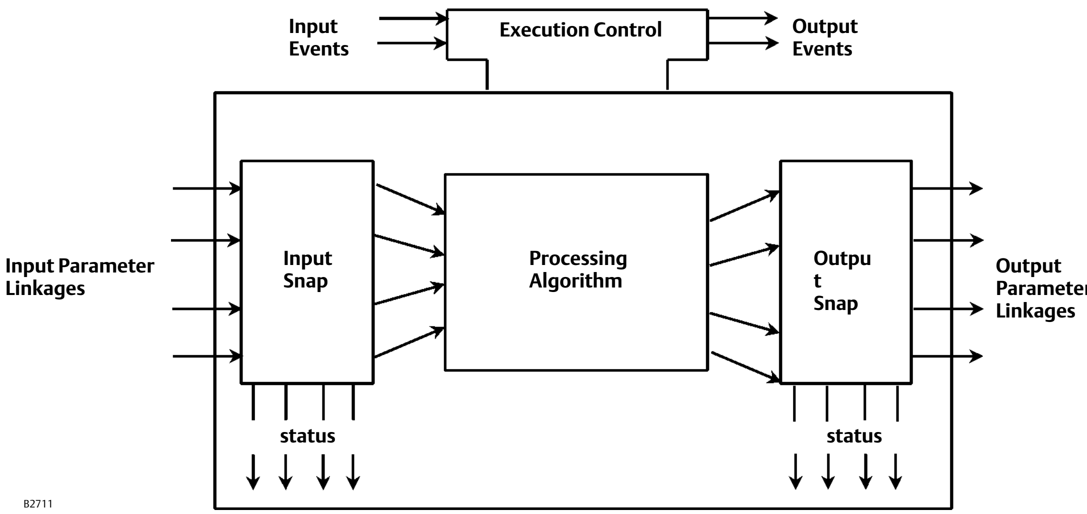
Once the inputs are snapped, the algorithm operates on them, generating outputs as it progresses. Algorithm executions are controlled through the setting of internal parameters. Internal parameters do not appear as normal

input and output parameters. However, they may be accessed and modified remotely, as specified by the function block.

Figure C‐1 illustrates the internal structure of a function block. When execution begins, input parameter values from other blocks are snapped‐in by the block. The input snap process ensures that these values do not change during the block execution. New values received for these parameters do not affect the snapped values and will not be used by the function block during the current execution.

Function blocks are also capable of performing short-term data collection and storage for reviewing their behavior.

Figure C‐1. Function Block Internal Structure



Instrument-Specific Blocks

In addition to function blocks, fieldbus devices contain two other block types to support the function blocks. These are the resource block and the transducer block. The resource block contains the hardware specific characteristics associated with a device. Transducer blocks couple the function blocks to local input/output functions.

Resource Blocks

The resource block contains hardware specific characteristics associated with the device; it has no input or output parameters. The algorithm within a resource block monitors and controls the general operation of the physical device hardware. The execution of this algorithm is dependent on the characteristics of the physical device, as defined by the manufacturer. As a result of this activity, the algorithm may cause the generation of events. There is only one resource block defined for a device. For example, placing the resource block in Out of Service mode stops all function block execution, by setting their modes to Out of Service as well. The actual mode of the function blocks is changed to Out of Service, but the function block target modes will not change. Placing the resource block in the Out of Service mode does not affect the mode of the transducer block.

Transducer Blocks

Transducer blocks connect function blocks to local input/output functions. They read sensor hardware and write to effector (actuator) hardware. This permits the transducer block to execute as frequently as necessary to obtain good

data from sensors and ensure proper writes to the actuator without burdening the function blocks that use the data. The transducer block also isolates the function block from the specific characteristics of the physical I/O.

Block Modes

All blocks have modes. The mode determines the source of the set point, the destination of the output, how the block executes, and the relationship between setpoint and output. The block mode is determined by the Block Mode parameter. It is a structured parameter composed of the attributes actual, target, permitted, and normal. The following defines each of the attributes.

- Target mode—The Target mode is the mode requested by the user or host system. Only one mode is allowed to be set and it must be a permitted mode as defined by the permitted attribute of the mode parameter.
- Actual mode—This is the current mode of the block. The actual mode may differ from the target mode due to operating conditions of the block.
- Permitted mode—The permitted mode defines the modes allowed for the block. This is set by the user or host system but is restricted by the instrument to modes supported by the instrument for the particular block. Any change request to the Target or Normal attribute is checked against the permitted attribute to ensure the requested mode is permitted.

When setting the Permitted mode, there is no check against any of the other attributes (Normal or Target modes). Therefore, the normal or target mode attributes may have a value that is not permitted because the permitted attribute was modified after the Normal or Target mode was set. This will have no effect on the instrument until the user attempts to

modify the Target or Normal mode. At this time these attributes are tested against the Permitted modes, thus the user cannot change the Normal or Target modes to what was formerly permitted.

- Normal mode—The normal mode is the mode the block should be in during normal operating conditions. The normal mode is set by the user or host system and can only be set to a permitted mode (see permitted mode). The user or host system can compare the actual mode to the normal mode and, based on the results, determine if the block is operating normally.

Table C-1 lists the modes supported by each block contained in the digital level controller.

Table C-1. FIELDVUE DLC3020f Block Modes

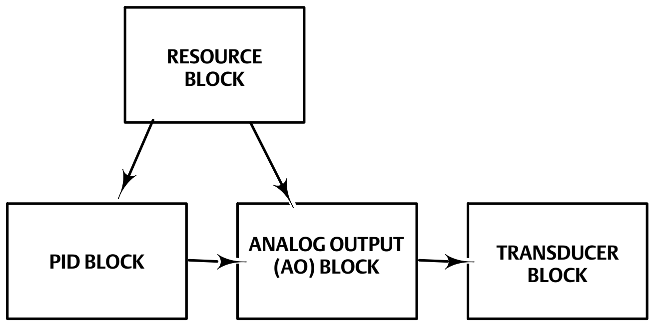
Block	Supported Mode Values
Resource	Auto and OOS
Transducer	Auto, Manual, and OOS
AO	RCas, Cas, Auto, Man, LO(1), IMan(1), and OOS
PID	ROut, RCas, Cas, Auto, Man, LO(1), IMan(1), and OOS
ISEL	Auto, Man, and OOS
AI	Man, Auto, and OOS
DI	Auto, Man, and OOS
ARTH	Man, OOS, and Auto

1. This mode cannot be specified as a target mode.

Changing the block mode requires accessing the Block Mode parameter. For information on using the host system to change the block mode via this parameter, see the appropriate host documentation.

Note
A downstream block changing to Out of Service impacts the mode of the upstream block. Refer to the block hierarchy in figure C-2.

Figure C-2. Block Hierarchy Example



NOTES:
1. CHANGING THE RESOURCE BLOCK TO OUT OF SERVICE CHANGES ALL FUNCTION BLOCKS TO OUT OF SERVICE, BUT DOES NOT AFFECT THE TRANSDUCER BLOCK.
2. CHANGING A DOWNSTREAM BLOCK TO OUT OF SERVICE AFFECTS THE UP STREAM BLOCK. FOR EXAMPLE: WHEN THE TRANSDUCER BLOCK IS OUT OF SERVICE, THE AO BLOCK MODE WILL CHANGE TO IMAN (INITIALIZE MANUAL).

Note

There in no mode associated with the FOUNDATION fieldbus Loop. Mode is dependent on the blocks within the Loop.

Explanation of Modes

Out of Service (OOS)—The functions performed by the block are not executed. If the block has any outputs, these typically do not update and the status of any values passed to downstream blocks will be “BAD”. To make changes to some of the parameters in a block requires that the block be Out of Service.

Initialization Manual (IMan)—Only the AO, DO, OS and PID blocks support this mode. When one of these blocks detects a loss of a correct path to the downstream block (such as when the downstream block is in the OOS, Man, or LO mode), it enters the IMan mode. For example, when the transducer block enters the OOS mode, the AO block enters the IMan mode.

Local Override (LO)—Only the AO and PID blocks support this mode. If the PID block enters the LO mode, the block output follows the tracking value (TRK_VAL), if external tracking is enabled by TRK_IN_D. In the AO and DO block, the block enters LO mode when the block detects that fault state is active. In this case, the output is determined by the selection for I/O_OPTS.

Manual (Man)—If the data status of a function block's input is bad or its target mode is Man, the block enters the manual mode. In this mode, the function block does not update its OUT value. If the target is Man, the user may write a desired value to the output.

Automatic (Auto)—The block performs the specified calculations based on the local set point and outputs the result, independently without interfacing with another block. The user can write to the set point of a block in this mode. Any block outputs continue to update.

Cascade (Cas)—The block performs the specified calculations based on the set point from another block via the cascade input parameter and outputs the result. Any block outputs continue to update.

Remote Output (ROut)—The block outputs are set to the value of the remote output parameter that is written by a host computer or others. To prevent a sudden change in output, the block's calculations are initialized when a change in mode occurs.

Remote Cascade (RCas)—The block performs the specified calculations based on a set point from a host computer or others via the remote cascade input and outputs the result. If the block has any outputs, these continue to update.

Examples of Modes for Various Operational Statuses

Table C-2 shows examples of block mode combinations in a digital level controller (however it does not show all combinations). When a block changes mode or the data status signal changes for some reason, the other blocks connected to that block identify the change by detecting the change in status of an input signal, and change their modes too. For example, when the data status of BKCAL_IN in a PID block changes to bad, the PID block automatically changes its mode to Iman to initialize the control of its downstream block.

Table C-2. Examples of Block Mode Combinations and Operational statuses for an Instrument with Standard Control

Operational Status	Blocks		
	PID	AO	TB(1)
Initial Setup and calibration	- - -	OOS	OOS
Modification of some transducer block parameters	- - -	IMan	Manual
Constant valve position control	- - -	Auto	Auto
PID Single-loop control	Auto	Cas	Auto
PID Cascade-loop control	Primary PID, Auto Secondary PID, Cas	Cas	Auto

1. TB=Transducer Block

The respective modes to which each block should enter upon occurrence of a communication error and at a restart, and the handling of signals in each mode may be defined in the block's option parameters such as IO_OPTS and STATUS_OPTS. For details, see the detailed descriptions of each function block.

Device Descriptions

Device Descriptions are specified definitions that are associated with blocks. Device descriptions provide for the definition and description of blocks and their parameters.

Device descriptions may also include a set of processing routines called Methods. Methods provide a procedure for accessing and manipulating a series of parameters within a device, such as for setup and calibration. Methods are used for a variety of functions including automatic calibration, setting protection and setting up the instrument. These Methods are a predetermined sequence of steps for information required to setup, calibrate, and perform other functions on the instrument.

Transducer Block Status and Limit Propagation

Every FOUNDATION fieldbus parameter has a value and a status. The status attribute is divided into three components: Quality, Quality substatus, and a Limit. The Quality can be Good (Cascade), Good (Non-Cascade), Uncertain, and Bad. Each quality can have a substatus as shown in table C-3. Each status attribute also has four possible limit states: Not limited, Low limited, High limited, and Constant. Refer to the Fieldbus Foundation specifications for a more detailed description. The following describes how the transducer block passes status information to the AO block. For information on status handling by the function blocks within the digital level controller, refer to the Detailed Setup section.

Table C-3. Status Attribute Quality and Substatus Components

Quality	Substatus
Good (NC)	Non-specific
Good (NC)	Active Block Alarm
Good (NC)	Active Advisory Alarm
Good (NC)	Active Critical Alarm
Good (NC)	Unack Block Alarm
Good (NC)	Unack Advisory Alarm
Good (NC)	Unack Critical Alarm
Uncertain	Non-specific
Uncertain	Last Usable Value
Uncertain	Substitute/Manual Entry
Uncertain	Initial Value
Uncertain	Sensor Conversion not Accurate
Uncertain	Engineering Unit Range Violation
Uncertain	Sub-normal
Good (C)	Non-specific
Good (C)	Initialization Acknowledge
Good (C)	Initialization Request
Good (C)	Not Invited
Good (C)	Not Selected
Good (C)	Local Override
Good (C)	Fault State Active
Good (C)	Initiate Fault State
Bad	Non-specific
Bad	Configuration Error
Bad	Not Connected
Bad	Device Failure
Bad	Sensor Failure
Bad	No Comm, with LUV
Bad	No Comm, no LUV
Bad	Out of Service
(NC)=(Non-cascade) (C)= (Cascade)	

Status Propagation

The transducer block accepts the output from the AO block or DO block if the output parameter status is Good (Non-cascade) or Good (Cascade). When the AO or DO block is Out of Service the output parameter status is Bad. In this case, the transducer block holds the last value.

If the transducer block actual mode is Out of Service, the AO block READBACK parameter status is Bad-Out of Service. This could be caused by a Failed Alert. If a Failed Alert is active, the block error parameter (parameter name BLOCK_ERR) for the Resource block will indicate Device Needs Maintenance Now. For more information on the Resource and Transducer block error indications, refer to the Viewing Device Information section of this manual.

If the transducer block is functioning correctly the AO block READBACK parameter status is Good (Non-cascade)-Non-specific. If a Maintenance or Advisory alert is active the substatus will reflect a Unacknowledged or Active advisory alert. When a Maintenance or Advisory alert is active, the block error for the resource block indicates Device Needs Maintenance Soon.

Limit Propagation

The following describes limit propagation:

AO Block

- If the valve position is below the low cutoff value, the AO block READBACK status limit is LOW_LIMITED.
- If the valve position is above the high cutoff value, the AO block READBACK status limit is HIGH_LIMITED.
- If the transducer block actual mode is Auto and the above conditions are not true, the AO block READBACK status limit is NOT_LIMITED.
- If the transducer block actual mode is Out of Service, the AO block READBACK status limit is CONSTANT.

DO Block

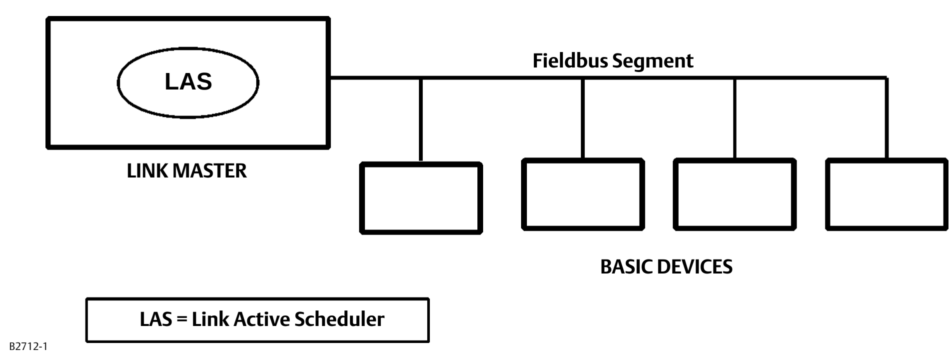
- If the transducer block actual mode is Auto, the DO block READBACK_D status is NOT_LIMITED.
- If the transducer block actual mode is Out of Service, the DO block READBACK_D status is CONSTANT.

The control strategy should be configured to monitor the Analog Output block status and take action where appropriate when the status is no longer Good.

Network Communication

Figure C-3 illustrates a simple fieldbus network consisting of a single segment.

Figure C-3. Simple Single-Link Fieldbus Network



Device Addressing

Fieldbus uses addresses between 0 and 255. Addresses 0 through 15 are typically reserved for group addressing and for use by the data link layer. If there are two or more devices with the same address, the first device to start will use its programmed address. Each of the other devices will be given one of four temporary addresses between 248 and 251. If a temporary address is not available, the device will be unavailable until a temporary address becomes available. Commission devices use addresses 20-35, and standby devices use addresses 232-247.

Link Active Scheduler (LAS)

There is only one active Link Active Scheduler (LAS) for the entire fieldbus control system. The digital level controller includes an LAS. The Link Active Scheduler operates as the bus arbiter for the link, and

- recognizes and adds new devices to the link.
- removes non-responsive devices from the link.
- distributes Data Link (DL) and Link Scheduling (LS) time on the link. Data Link Time is a network-wide time periodically distributed by the LAS to synchronize all device clocks on the bus. Link Scheduling time is a link-specific time represented as an offset from Data Link Time. It is used to indicate when the LAS on each link begins and repeats its schedule. It is used by system management to synchronize function block execution with the data transfers scheduled by the LAS.
- polls devices for process loop data at scheduled transmission times.
- distributes a priority-driven token to devices between scheduled transmissions.

The DLC3020f can be designated to act as the backup Link Active Scheduler (LAS) in the event that the LAS is disconnected from the segment. As the backup LAS, the DLC3020f will take over the management of communications until the host is restored. The host system may provide a configuration tool specifically designed to designate a particular device as a backup LAS. Otherwise, this can be configured manually as follows:

1. Access the Management Information Base (MIB) for the DLC3020f
2. To activate the LAS capability, write 0x02 to the BOOT_OPERAT_FUNCTIONAL_CLASS object (Index 605). To deactivate, write 0x01.

Restart the processor.

Only one device can communicate at a time. Permission to communicate on the bus is controlled by a centralized token passed between devices by the LAS. Only the device with the token can communicate. The LAS maintains a list of all devices are a member of the bus. This list is called the “Live List”.

Two types of tokens are used by the LAS. A time-critical token, compel data (CD), is sent by the LAS according to a schedule. A non-time critical token, pass token (PT), is sent by the LAS to each device in numerical order according to address.

Device Communication

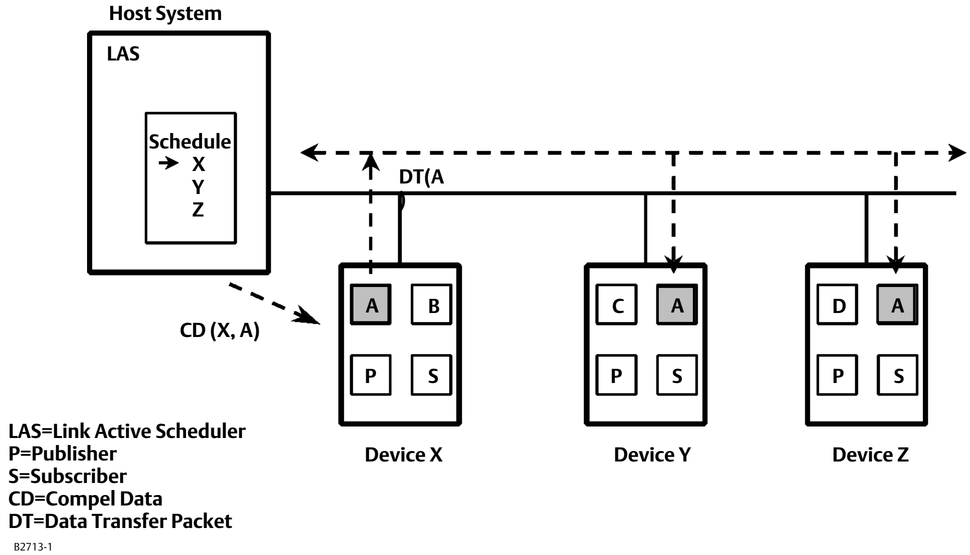
Scheduled Transfers

Information is transferred between devices over the fieldbus using three different types of communication:

- **Publisher/Subscriber:** This type of communication is used to transfer critical process loop data, such as the process variable. The data producers (publishers) post the data in a buffer that is transmitted to the subscriber (S), when the publisher is issued the Compel Data (CD) message from the LAS. The buffer contains only one copy of the data. New data completely overwrites previous data. Updates to published data are transferred simultaneously to all subscribers in a single broadcast. Transfers of this type are scheduled on a precisely periodic basis.

Figure C-4 diagrams the method of scheduled data transfer. Scheduled data transfers are typically used for the regular cyclic transfer of process loop data between devices on the fieldbus. Scheduled transfers use publisher/subscriber type of reporting for data transfer. The Link Active Scheduler maintains a list of transmit times for all publishers in all devices that need to be cyclically transmitted. When it is time for a device to publish data, the LAS issues a Compel Data (CD) message to the device. Upon receipt of the CD, the device broadcasts or “publishes” the data to all devices on the fieldbus. Any device that is configured to receive the data is called a “subscriber”.

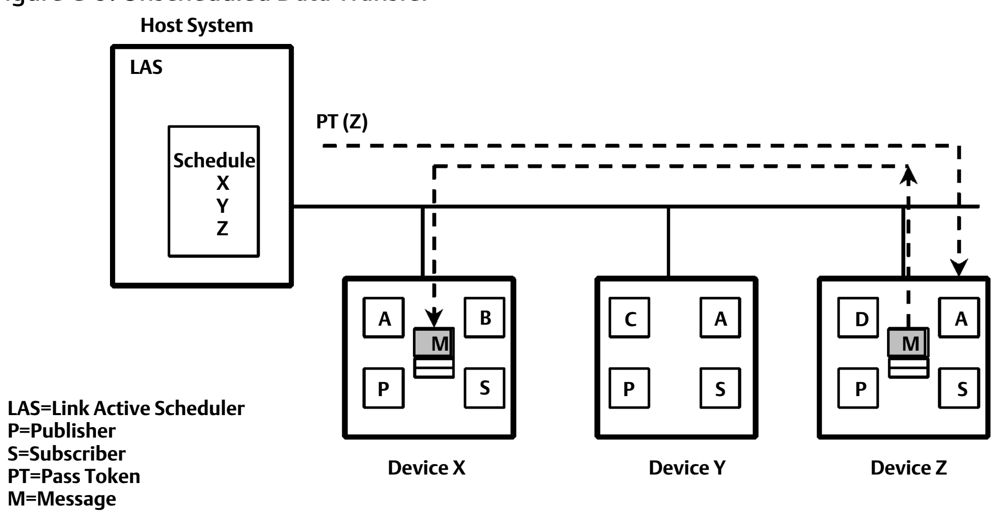
Figure C-4. Scheduled Data Transfer



Unscheduled Transfers

Figure C-5 diagrams an unscheduled transfer. Unscheduled transfers are used for things like user-initiated changes, including set point changes, mode changes, tuning changes, and upload/download. Unscheduled transfers use either report distribution or client/server type of reporting for transferring data.

Figure C-5. Unscheduled Data Transfer



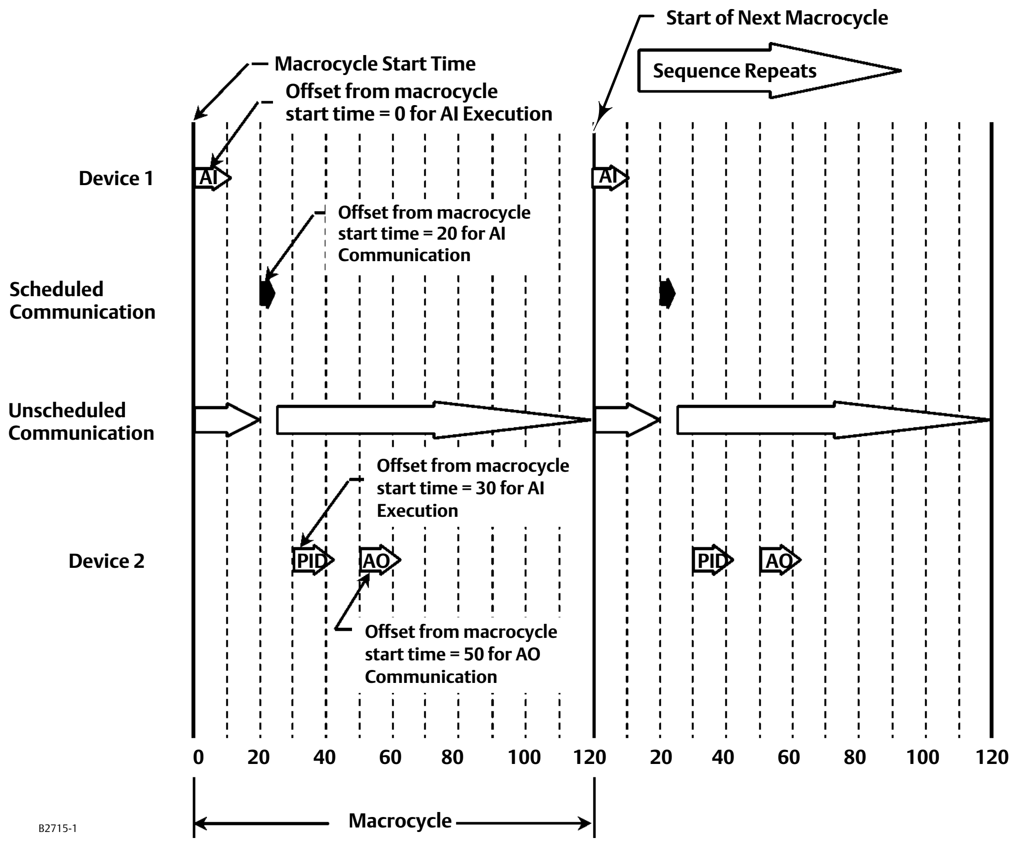
All of the devices on the fieldbus are given a chance to send unscheduled messages between transmissions of scheduled data. The LAS grants permission to a device to use the fieldbus by issuing a pass token (PT) message to the device. When the device receives the PT, it is allowed to send messages until it has finished or until the “maximum token hold time” has expired, whichever is the shorter time. The message may be sent to a single destination or to multiple destinations.

- Report Distribution: This type of communication is used to broadcast and multicast event and trend reports.
- Client/Server: This type of communication is used for request/ response exchanges between pairs of devices, such as a set point change. Like Report Distribution reporting, the transfers are queued, unscheduled, and prioritized. Queued means the messages are sent and received in the order submitted for transmission, according to their priority, without overwriting previous messages.

Function Block Scheduling

Figure C-6 shows an example of a link schedule. A single iteration of the link-wide schedule is called the macrocycle. When the system is configured and the function blocks are linked, a master link-wide schedule is created for the LAS. Each device maintains its portion of the link-wide schedule, known as the Function Block Schedule. The Function Block Schedule indicates when the function blocks for the device are to be executed. The scheduled execution time for each function block is represented as an offset from the beginning of the macrocycle start time.

Figure C-6. Example Link Schedule Showing Scheduled and Unscheduled Communication



To support synchronization of schedules, periodically Link Scheduling (LS) time is distributed. The beginning of the macrocycle represents a common starting time for all Function Block schedules on a link and for the LAS link-wide schedule. This permits function block executions and their corresponding data transfers to be synchronized in time.

Network Management

Information for setting up network communications, including Virtual Communication Relationships (VCRs), host timer recommendations, and other network parameters, can be found in the capabilities file (.cff) available from the website www.FIELDVUE.com or from the Fieldbus Foundation website.

Glossary

Alarm Deadband
The amount by which the process variable must return within normal limits for the alarm to clear.

Alarm Limit
An adjustable value that, when exceeded, activates an alert.

Algorithm
A set of logical steps to solve a problem or accomplish a task. A computer program contains one or more algorithms.

Alphanumeric
Consisting of letters and numbers.

ANSI (acronym)
The acronym ANSI stands for the American National Standards Institute

Byte
A unit of binary digits (bits). A byte consists of eight bits.

Commissioning
Functions performed with a Field Communicator and the digital level controller to test the instrument and loop and verify digital level controller configuration data.

Configuration
Stored instructions and operating parameters for a FIELDVUE Instrument.

Control Loop
An arrangement of physical and electronic components for process control. The electronic components of the loop continuously measure one or more aspects of the process, then alter those aspects as necessary to achieve a desired process condition. A simple control loop measures only one variable. More sophisticated control loops measure many variables and maintain specified relationships among those variables.

Damping
Output function that increases the time constant of the digital level controller output to smooth the output when there are rapid input variations.

Descriptor
Sixteen-character field for additional identification of the digital level controller, its use, or location. The descriptor is stored in the instrument and can be changed using a Field Communicator and the device information function.

Device ID
Unique identifier embedded in the instrument at the factory.

Device Revision
Revision number of the interface software that permits communication between the Field Communicator and the instrument.

Firmware Revision
The revision number of the instrument firmware. Firmware is a program that is entered into the instrument at time of manufacture and cannot be changed by the user.

Free Time
Percent of time that the microprocessor is idle. A typical value is 25%. The actual value depends on the number of functions in the instrument that are enabled and on the amount of communication currently in progress.

Gain
The ratio of output change to input change.

Hardware Revision
Revision number of the Fisher instrument hardware. The physical components of the instrument are defined as the hardware.

Instrument Serial Number
The serial number assigned to the instrument.

Lower Range Value (LRV)
Lowest value of the process variable that the digital level controller is currently configured to measure in the 4 to 20 mA loop.

Lower Sensor Limit (LSL)
Lowest value of the process variable that the digital level controller can be configured to measure.

Memory
A type of semiconductor used for storing programs or data. FIELDVUE instruments use three types of memory: Random Access Memory (RAM), Read Only Memory (ROM), and Non-Volatile Memory (NVM). See also these listings in this glossary.

Menu
A list of programs, commands, or other activities that you select by using the arrow keys to highlight the item then pressing ENTER, or by entering the numeric value of the menu item.

Message
Thirty-two character field for any additional information the user may want to include.

Multidropping
The connection of several field devices to a single communications transmission line.

Non-Volatile Memory (NVM)
A type of semiconductor memory that retains its contents even though power is disconnected. NVM contents can be changed during configuration unlike ROM which can be changed only at time of instrument manufacture. NVM stores configuration data.

On-Line Configuration
Configuration of the digital level controller operational parameters using a Field Communicator connected to the instrument.

Parallel
Simultaneous: said of data transmission on two or more channels at the same time.

Polling Address
Address of the instrument. If the digital level controller is used in a point-to-point configuration, set the polling address to 0. If it is used in a multidrop configuration, or split range application, set the polling address to a value from 0 to 15.

Process Variable (PV)
A physical quality or quantity which is monitored as part of a control strategy. The digital level controller can measure level, interface level between two liquids of different specific gravity, and liquid density.

Protocol
A set of data formats and transmission rules for communication between electronic devices. Devices that conform to the same protocol can communicate accurately.

Random Access Memory (RAM)
A type of semiconductor memory that is normally used by the microprocessor during normal operation that permits rapid retrieval and storage of programs and data. See also Read Only Memory (ROM) and Non-Volatile Memory (NVM).

Read-Only Memory (ROM)
A memory in which information is stored at the time of instrument manufacture. You can examine but not change ROM contents.

Reranging
Configuration function that changes the digital level controller 4 to 20 mA settings.

RTD
The abbreviation for resistance temperature detector. Temperature is measured by the RTD by correlating the resistance of the RTD element with temperature.

Send Data
A Field Communicator command that transfers configuration data from the Field Communicator's working register to the digital level controller memory.

Software
Microprocessor or computer programs and routines that reside in alterable memory (usually RAM), as opposed to firmware, which consists of programs and routines that are programmed into memory (usually ROM) when the instrument is manufactured. Software can be manipulated during normal operation, firmware cannot.

Span
Algebraic difference between the upper and lower range values.

Temperature Sensor
A device within the instrument that measures the instrument's internal temperature.

Upper Range Value (URV)
Highest value of the process variable that the digital level controller is currently configured to measure in the 4 to 20 mA loop.

Upper Sensor Limit (USL)
Highest value of the process variable that the digital level controller can be configured to measure.

Working Register
Memory location in a Field Communicator that temporarily stores data as it is being entered.

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